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ABSTRACT

This manual provides a resource for mathematics teachers who wish to take advantage of the extensive library of computer software materials available to expand and strengthen classroom instruction. Classroom management procedures, software duplication guidelines, copying procedures of diskettes for MS DOS and Apple II computers, and methods for managing diskettes are described. Included are 109 classroom activities for teaching mathematical concepts using computers. The aim, objectives, vocabulary, materials, preparation, motivation, development, application, summary, and homework are provided for each activity. Activities are classified into the following categories: (1) Numbers and Numeration; (2) Addition; (3) Subtraction; (4) Multiplication; (5) Division; (6) Fractions; (7) Decimals; (8) Geometry; (9) Signed Numbers; (10) Measurement; and (11) Data and Graphing. A list of 32 software programs used in this guide is presented. (YP)

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COMPUTERS IN
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NEW YORK CITY
BOARD OF EDUCATION

DIVISION OF COMPUTER
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COMPUTERS IN
Fundamental Mathematics

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Foreword

The rapid establishment of the computer as a routine instrument of instruction and its successful integration within curricula inspires educators to continue to explore its potential and expand its applications.

The purpose of this guide is to offer teachers and supervisors a working knowledge of current approaches to the direct application of the computer to the classroom, from which we can count on them to constantly devise new ideas for its use. Since computer-centered instruction rests upon a dynamic, evolving technology, only flexible and contemporary methods and materials will lead to fulfillment of its possibilities for the benefit of our children. We encourage our colleagues to experiment freely from the base of this guide's lesson plans and suggestions, and to work in concert with us to assure the computer's continued use as an efficient classroom tool.

I invite you to write to me directly with any comments or suggestions.

Irwin Kaufman

Irwin Kaufman, Chief Information Officer
New York City Board of Education

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Introduction: How to Use This Guide

The purpose of this manual is to provide a relevant resource for mathematics teachers who wish to take advantage of the extensive library of computer software materials available to expand and strengthen classroom instruction, as well as use alternative methodology.

Computers in Fundamental Mathematics presents selected lesson plans which will facilitate the integration of computer-based instruction with the regular methods practiced by teachers. These plans not only indicate the features of the software, but also represent a sharing of ideas on its applications by teachers who have had successful experiences with computers and enriching mathematical concepts and skills.

It must be emphasized that this collection of suggested lessons is *not* intended as a sequential course, but rather as a reference and guide from which teachers may draw to the extent and in the manner they deem appropriate for their students.

Teachers should familiarize themselves with the section of this book on "Classroom Management Procedures" before using the computer lab with their classes. Those who require more information on specific programs, such as electronic spreadsheets or data bases, are referred to the Division of Computer Information Services publications *Apple Tool Software* and *MS DOS Tool Software*. Further assistance may always be obtained from your local Technical Assistance Center. (See "For More Help...")

It is expected that as teachers gain in experience with the computer as a teaching tool and in familiarity with the software content and flexibility of its use, they will not only utilize the plans increasingly, but will also devise many new strategies for future development of these materials.

Preface: Computers - Teaching Tool

Computers were obviously not in mind when antislavery preacher Henry Ward Beecher offered this defense of technology over a hundred years ago:

> "A tool is but an extension of a man's hand, and
> a machine is but a complex tool..."

We may nevertheless find in it encouragement in considering their applicability to teaching and learning. Teachers already seasoned in computer-based instruction understand its power in raising instructional effectiveness, and are free of unwarranted concern about bypassing human reason and the loss of affective considerations. Others, at the threshold of engaging this seemingly robotic methodology, may confidently expect that even these complex machines are simply extended tools of instruction. They are fully controlled by the instructor's hands as readily as the conventional ones - chalk, textbooks and the like.

Teachers may anticipate at least the following advantages to incorporating the computer into their regular instructional program:

- students may study individually, and yet together, on synchronized exercises
- each student is required to focus attention narrowly; the graphic, repeatable presentations and explanations may ensure a clearer understanding of the lesson's topic
- it allows a greater immediacy of active, individual response for a greater number of students
- it gives students immediate feedback to their responses
- students may work at their own pace rather than at the pace of an imaginary class median
- it makes possible a more extended contact with the subject matter, as an individual or as part of a small group
- it affords absentees a certain and convenient way to catch up on missed studies
- it opens up to teachers strategies to make more efficient use of class time than some traditional question-and-answer lessons
- students' responses are treated in a nonjudgemental way, which may make learning more comfortable for some students; it never gets tired of a demand for countless repetitions of the same instruction
- it may free the teacher of not just routine instructional tasks but also tiresome chores of keeping records of student needs and progress
- an additional varied approach to presentation and drill is made available

it holds an intrinsic motivational quality that may increase student interest, concentration and retention

Experienced teachers will quickly recognize that these established advantages are thoroughly consistent with sound teaching practices and, skillfully applied, provide considerable support for their efforts to provide students with optimally effective and interesting instruction.

We are confident that the enclosed software will make teaching and learning a little more rewarding and enjoyable for you and your students.

Classroom Management Procedures

Thirty-six students working independently at 16 or more computer stations can easily lead to an almost chaotic confusion during a computer lab period, particularly if finding and distributing each student's working diskette takes too much time at the start. In addition, your ability to retrieve the performance information the program will record for each student depends upon carefully organizing the distribution and collection of the diskettes from the start. For these reasons, and a host of others, it is a good idea to think of classroom management procedures long before the computer lab period actually takes place, and to structure both the computer period and the computer room in ways that will make the period run smoothly and effectively.

In an ideal world each of your students would be able to work independently at a computer workstation, and that situation may exist in some classrooms at some times during the year. But most classes consist of 30 or more students and most computer labs of 16 or fewer workstations; the large number of workstations and the larger number of students require careful record keeping and classroom management. Students must work in a highly structured environment in the lab or they will accomplish much less than you expect them to.

The following outline of suggested procedures will help you create a structured computer lab; after a few periods in the lab you may want to modify the procedures to better suit your own needs.

I. Before the computer lab period.

1. If you are not familiar with the computers in your school, or not entirely comfortable with them, spend some time working with them on your own before you guide your students in using them. Your uncertainty or uneasiness about computers may leave you at a loss at some point in your lesson or be transmitted to those of your students who also feel intimidated by the machine. In either case it will have a negative effect on your lesson.

2. Preview the software you intend to use thoroughly. Learn what it does and how it works. Find out what background information your students will need to run the program --for example, what vocabulary they will have to know. Once 16 groups of students start working and, presumably, asking questions, it will be impossible to decipher anything about the program that you, and they, may find confusing.

3. Number each workstation in the computer lab clearly, so that you and the students can see the numbers easily.

4. The copyright of the enclosed diskettes belongs exclusively to the New York City Board of Education. Any New York City public school employee may make an unlimited number of these diskettes for use in the New York City Public Schools, either in day or evening sessions, without obtaining further permission. Use the DOS diskcopy command to create one set of operating diskettes of the program you plan to use for each student in the lab, plus some extras in case a few of your copies don't function or are lost. Do this for each class with which you intend to use the program. After you have made as many copies as you need, place the original program diskette in a secure place for future duplication.

   If it isn't possible to copy one student working diskette for each member of the class, you can use one diskette at each workstation. However, the advantages of individual student diskettes outweigh the disadvantages, and by a wide margin. Diskettes are relatively inexpensive, particularly when they are ordered in large quantities, and you will be able to use them year after year, virtually forever, simply be recopying the original program diskette over them whenever a class completes the program. In addition, providing each student with an individual diskette will prevent certain student generated errors from occurring and make classroom management and student evaluation much easier for you. Refer to the section of this booklet entitled "Software Duplication Guidelines" for copying instructions and for information about obtaining diskettes through a Bureau of Supplies contract.

5. Clearly label each diskette to coincide with one of the workstations--i.e., diskette number 14 must always be used at workstation 14. (Of course, any diskette will work at any station, but for classroom management purposes make sure the students follow this rule strictly.)

6. Divide your class into workstation groups of two, three, or four students, as needed. Look over the student combinations carefully before making final assignments. If you don't feel that a particular combination of students will work well together for an extended period of time, don't allow them to form a group. Once a group has been established, it will be necessary for those students to work together through each of the modules in the program, a procedure that can last for weeks.

7. Assign each group a work station number and keep a close record of the names of the group members and their group number. Each group should work at the same workstation through the entire program, and with the same student operating diskette. Each student operating diskette will eventually hold all of the records of only those students who use that diskette.

   If a student uses a different diskette each time he works, the records will be scattered among them all, and it will be difficult to retrieve them; for 30 or more students it would be too time consuming to be feasible.

8. As an extra precaution, label each diskette with the names of the students who will use it.

II. During the computer lab period.

1. At the beginning of the period have the students sit at their assigned workstations, with no exceptions. Then distribute the diskettes according to their corresponding numbers; the student names on the diskettes should also correspond to the students who are at each workstation.

2. At the end of the period collect the diskettes and store them in numerical order to make their distribution at the next period easier.

3. Once you have established workstation groups, assignments, and procedures, resist any temptation to make changes unless the changes will clearly be to your advantage. As in any classroom, the closer you follow established procedures, the more control you will maintain over the period and the more effective the use of the software will be.

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PART I

Numbers and Numeration

TOPIC 1: Finding Numbers in a Range of 0 to 5

Aim: How can we guess an unknown number with the fewest guesses?

✔

Performance Objectives: Student will be able to:

- guess numbers within a specific range
- correctly respond to hints: greater than or less than
- create stategies to guess numbers (using hints), in a logical fashion

Materials:

- Apple computer lab (color monitors)
- software: Bumble Games by the Learning Co. (also available for Commodore computers)

Motivation: Write the following on the chalkboard:

> What is the number I am thinking of? What hint could you use after the first guess? (Is it higher or lower?)

Development:

1. Write 0,1,2,3,4,5 on a number line on the chalkboard. Let a student guess the "unknown number." Draw an arrow explaining that the number is greater or less than the number guessed.
2. Use vertical, as well as horizontal number lines to display numbers on the chalkboard.
3. Give various examples on the chalkboard.
4. Tell students that the program they are about to use will teach them how to guess unknown numbers on a number line.
5. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.
6. When the menu appears on the screen, instruct the students to select option 1 - FIND YOUR NUMBER.
7. A number line will appear and the computer will play the guessing game by itself. The screen will ask if the students want instructions (Y or N). Tell them to type Y.
8. The instructions are simple, using easy vocabulary. Tell the students to read them. Answer any questions at this time.
9. The screen then asks HOW MANY PLAYERS (1 or 2). For the first time users, the one player mode is suggested (2 to 3 students at each computer).
10. The first number line appears. The prompt is "FIND YOUR NUMBER". If correctly chosen, music from the movie "ET" is heard and the student is congratulated. If incorrect the arrow points in the correct direction and further prompts "IT'S GREATER THAN (the selected number). FIND YOUR NUMBER. or IT'S LESS THAN (the selected number). FIND YOUR NUMBER."
11. After the correct guess, the screen identifies the number of tries, and prompts to PLAY AGAIN? (Y or N). Type Y.

12. A 15-minute session is recommended.

Summary:

1. What numbers are between 1 and 5?
2. What number is between 3 and 5?
3. What numbers are less than 5?
4. What number is less than 5, but greater than 3?

Homework: See attached homework sheet.

Enrichment:

1. To guess an unknown number in a range from 0 to 4, which would be the best number to guess first? Why?
2. To guess an unknown number in a range from 3 to 7, which would be the best number to guess first? Why?
3. To guess an unknown number in a range from 1 to 9, which would be the best number to guess first? Why?
4. In any range of numbers, which number would be the best to guess first? Why?

Homework Sheet:

Topic: Finding numbers in a range from 0 to 5

Part One: What numbers are between

1) 2 and 5 ____________ and ______________
2) 1 and 4 ____________ and ______________
3) 0 and 3 ____________ and ______________
4) 0 and 4 ____________ , ______________, and ____________
5) 1 and 5 ____________, ______________. and ____________

Part Two: What numbers are less than

1) 3 ______________, ____________, and ______________
2) 2 ______________ and ________________

Part Three: What number is

1) greater than 3, and less than 5
2) greater than 2, and less than 4
3) greater than 0, and less than 2

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TOPIC 2: Counting

Aim: What number identifies a set?

Performance Objectives: Students will be able to:

- match the count of a randomly-assigned set of objects with its numeral
- identify the numerals one through nine
- describe a set using a number

Materials:

- Apple lab
- software: Counting: An Action Approach to Counting and Arithmetic by Sunburst
- magnetic circles, buttons (9 for each student)
- number flash cards 1-9
- old magazines
- scissors
- paste and glue
- crayons
- construction paper

Motivation:

Sing a counting song. ie: One, Two, Buckle My Shoe or Ten Little Indians

Development:

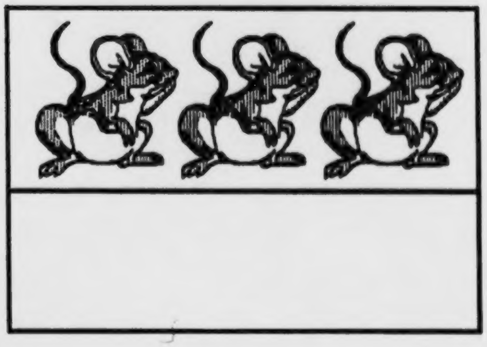
1. Place any number of magnetic circles from one to nine on the chalkboard. Have students count each circle aloud as the teacher points to the corresponding circle. Then ask the students to cover their eyes while the teacher removes one or more circles. As students look at the board, they should silently count the number of circles displayed. Ask the students to raise the same number of fingers as there are circles. Repeat this activity two or three times.

2. Have a student count aloud from one to nine as another student writes the numerals on the board.

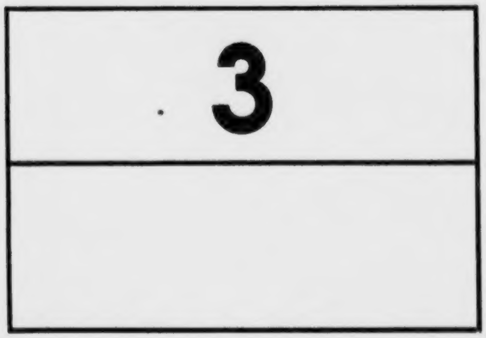
3. Explain to the students that they will be creating "number families" on the computer. The "number families" can consist of one, four or even nine members.

4. Draw a picture of the Counting-Activity three screen on the chalkboard. Tell the students that the computer will show them a "number family." Then, it will show them a number or numeral that represents the family.

i.e Frame/Screen 1



Frame\Screen 2



The computer will wait for the students to re-create the same "number family." It will send one object out at a time on the screen. When the students see and count the same number of objects that match the numeral displayed, they should press any key to freeze the screen. The computer will count each object by changing its color. The students should press any key to continue the program.

5. The teacher should demonstrate the program on the computer to the entire group of students. Answer any questions that are raised before allowing the children to start the activity.

6. All machines should be loaded before the students are assigned to a computer station. When the menu appears, the teacher should select Counting - Level 3.

7. Children should receive a reasonable amount of time to work on the activity (10-15 minutes).

Summary:

1. Write the numerals 1-9 on the chalkboard. Display a set of objects in the classroom (i.e. books, chalk, etc.)
   - How many numbers are in this set?
   - Which number matches the set of objects? (The student should circle the correct numeral.)

2. Distribute nine buttons to each student. Hold up a number flash card.
   - How many buttons are needed to match this number?

Homework:

Create a "number family" card. Randomly assign one or two numbers (1-9) each night. Students can cut out pictures from old magazines or gather small objects. (i.e. pictures of six cartons of milk or five real apple seeds). Fold the construction paper in half. Write the numeral for the set on the left in crayon and paste the set of objects on the right.

Enrichment:

Create an animal diorama for the number families.

TOPIC 3: Roman Numerals

Aim How do you read, write and add Roman numerals?

Performance Objectives: Students will be able to:

- identify the symbols used in Roman numerals
- explain the rules governing the placement of the symbols
- give the Roman numeral value for Arabic numbers through the one thousands
- change Roman numerals to Arabic numbers through the one thousands
- find the sum of Roman numerals through the one thousands

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra: Softwriters Development Corporation

Motivation:

Put the following table on the chalkboard.

	Thousands	Hundreds	Tens	Ones
	M	D,C	L,X	V,I
1329 =	1000 +	300 +	20 +	9
197 =				
47 =				
853 =				
1987 =				

Have students copy the table and complete it with expanded notation in simple form. Elicit from students or supply, if necessary, the values of the letter M,D,C,L,X,V and I (1000, 500, 100, 50, 10, 5 and 1, respectively). How do Roman numerals differ from a decimal, place-value number system? In what ways are they similar?

Development:

1. Put the following on the chalkboard:
   IV = 4 IX = 9 XC = 90 CM = 900
   VI = 6 XI = 11 CX = 110 MC = 1100

   How is addition used to form Roman numerals? How is subtraction used to form Roman numerals? Establish the concept that when one symbol for each place-value (i.e. I=1, X=10, C=100) is placed before a symbol of higher value, it is subtracted from that value.

2. Tell students that the program they are about to use will help them understand how to read, write and add Roman numerals.

3. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 5 in drive 2. Otherwise have disk 5 ready to replace disk 1 when the program so instructs.

4. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson; press 2 to select lesson. When a number grid appears use directional arrows to highlight lesson #21, and press RETURN. Follow

appropriate directions to load disk 5 and wait for lesson #21 to appear.

5. First some examples of Roman numerals and their Arabic values will appear; then the values of the symbols and the rules of placement will be explained. Numbers will be changed from Arabic to expanded notation and then to Roman numerals; the opposite conversion will then be shown. The lesson concludes with instructing students to add Roman numerals by converting each addend to an Arabic number, adding and then converting the sum back to Roman numerals. A quiz of 6 questions is given and the student's raw score and percent correct is given.

6. Allow students about 10-12 minutes for the computer activity. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

7. Optional: With able students, further develop the lesson by challenging students to add and even subtract Roman numerals without converting to Arabic numbers. Elicit from students and adaptation of "carrying" and "borrowing" which would apply to Roman numerals.

Summary:

1. What are the values of M,D,C,L,X,V and I in Roman numerals?
2. How are addition of letter values and subtraction of letter values used to form Roman numerals?
3. How are the numbers 4, 9, 40, 90, 400, and 900 written in Roman numerals?
4. How can Roman numerals be added using conversion to Arabic numbers?
5. How can Roman numerals be added without using conversion to Arabic numbers?

Homework:

Prepare a rexographed fill-in sheet listing the values of the Roman numeral symbols and then giving a list of 10-15 Roman numerals to be written in Arabic numbers and another 10-15 Arabic numbers to be written in Roman numerals (include fours and nines for each decimal place-value).

Enrichment:

Have students create five addition and five subtraction examples in Roman numerals and evaluate them without using Arabic conversions.

TOPIC 4: Place Value: Ones Through Thousands

Aim: How can we tell the value of each digit in a four-digit number?

Performance Objectives: Students will be able to:

- identify the place value of any digit in a numeral less than 9999
- identify the meaning of zero in the place value system
- write a given numeral in expanded form
- write a standard numeral when the expanded form is given

Materials:

- Apple computer lab (color monitors)
- software: Place Value Recognition II by Centurion Industries, Inc.
- squared materials
- concrete objects for place value charts

Motivation:

Write the following on the chalkboard:

357 = 300 + 50 + 7

Write the following numbers in expanded form as shown in the above example:

1) 859   2) 1678   3) 4927   4) 5600

Development:

1. After the motivation, demonstrate how expanded notation is used to show the value of numbers. Closely relate the place value chart to the expanded notation.

2. Tell the students that the program they are about to use will teach them how to find the value of different digits within a numeral.

3. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

4. After the programs are loaded, instruct the students to press the RETURN key four times slowly. This will get the students to the main menu without bothersome reading of production credits. It is suggested that the teacher emphasize that the RETURN key be touched very slowly and lightly, so that they don't pass the main menu.

5. Instruct the students to press the period (.) key. This will cause the screen to prompt for the inputting of a name. Since most class situations call for 2 to 3 students to operate a computer, the name MATH is suggested. Another suggestion is the inputting of each student's initials. Afterwards they press the RETURN key again.

6. A four-digit numeral appears on the screen. In addition, a name of a place value column appears (i.e. HUNDREDS).

7. The object is to utilize the SPACE BAR key to underline the appropriate digit in the numeral, that corresponds to the word flashed on the screen. The student then types the letter M.

8. If correct a smiling face appears and the student presses the RETURN key to continue. If incorrect, the correct response is provided immediately.

9. At the end of the program a summary of the student's work is provided. In addition, the program timed the student while at work.

10. It is suggested that one student at a time work through the program. Only ten problems are provided; therefore, the turnover of the students at work will be rapid. Afterwards the students can try again. This time the object will be to decrease the work time, while maintaining or increasing the accuracy.

11. Two sessions are recommended for this skill.

Summary:

1. What is the value of the 7 in 4,769?
2. What is the numeral that has two thousands and six ones?
3. Write 6,398 in the expanded notation.
4. Write the numeral that has 2 thousands + 6 hundreds + 4 tens + 9 ones.

Homework: See attached homework sheet.

Enrichment:

1. Place the digits: 2, 7, 5, and 6 in such an order as to make the greatest possible numeral.

2. Rearrange the digits in #1 to make the smallest possible numeral.

3. Place a 0 in the numeral 459 to make the largest possible four-digit numeral.

4. Rearrange the digits in #3 to make the least possible four-digit numeral.

Homework Sheet: Place Value: Ones Through Thousands

Part One: What is the value of 6 in the following numerals?

1) 5,967 ________
2) 4,386 ________
3) 6,290 ________
4) 5,643 ________
5) 6,285 ________
6) 6,823 ________
7) 4,546 ________
8) 8,267 ________
9) 2,876 ________
10) 6,800 ________
11) 4,634 ________
12) 1,008 ________
13) 0,086 ________
14) 6,789 ________
15) 1,008 ________

Part Two: Write the following numerals in the expanded notation:

1) 6,472 = 6 thousands + 4 hundreds + 7 tens + 2 ones
2) 4,268 =
3) 5,096 =
4) 4,860 =
5) 5,306 =

Part Three: Write the numeral that has:

1) 3 tens + 2 ones = 32
2) 5 thousands + 4 hundreds + 5 tens + 9 ones = ________
3) 6 thousands + 3 hundreds + 0 tens + 4 ones = ________
4) 2 thousands + 9 hundreds + 0 tens + 0 ones = ________
5) 5 hundreds + 2 ones + 3 thousands = ________
6) 2 ones + 5 hundreds + 3 tens + 6 thousands = ________
7) 4 tens + 2 ones + 5 hundreds + 0 thousands = ________

TOPIC 5: Rounding Numbers to the Nearest Ten

Performance Objectives: Student will be able to:

- identify the rounding interval
- round the number to the nearest ten

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Rounding by Bergwall Educational Software Inc.

Motivation:

What are the first 15 non-zero multiples of 10? (Hint: count by tens)

Development:

1. Elicit the answer to the Motivation from the students. (10,20,30,40,50,60,70,80,90,100,110,120,130,140,150,)

2. Tell the students that rounding numbers to the nearest ten is finding out which ten our number is closest to.

3. We would like to round 42 to the nearest ten.
   a) which two tens is 42 between? (40 and 50)
   b) Is 42 closer to 40 or 50? (40)
   Therefore 42 rounded to the nearest ten is 40.

4. Display a number line. It should be large and constructed on oaktag. The same procedure can be presented using a number line. (The program presents the topic graphically.)

```
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
     40    41    42    43    44    45    46    47    48    49    50
```

   a) Which two tens is 42 between? (40 and 50)
   b) Is 42 closer to 40 or 50? (40)
      Therefore 42 rounded to the nearest ten is 40
   c) If the number is 45, would the answer be 40 or 50?
      (if number in the middle, round higher. Answer is 50.)

5. Guide students through these problems. If possible, prepare a number line for each student.
   a) round 39 to the nearest ten
   b) round 64 to the nearest ten
   c) round 25 to the nearest ten (if number is in middle then round higher)
   d) round 172 to the nearest ten
   e) round 255 to the nearest ten
   f) round 199 to the nearest ten

6. Tell the students that the program they are about to use will teach them to round a number to the nearest ten.

7. This program presents a lesson. Upon completion of the lesson the student then practices the concept. The student then has the choice of skipping the lesson and doing the practice; starting over again or quitting the program.

Summary:

1. How do we identify the rounding interval?
2. How do we round the number to the nearest ten?
3. How do we round a number to the nearest ten if it is in the middle, such as 25 or 265?
4. Did using the computer program help you to understand this lesson? Explain.

Homework:

Round each number to the nearest ten: Answer these questions to help
a) between which two tens does the number to be rounded lie?
b) which ten is the number to be rounded closest to?
c) what is the rounded answer?

```
1.  1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1
         70    71    72    73    74    75    76    77    78    79    80

2.  1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1
          20    21    22    23    24    25    26    27    28    29    30

3.  1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1
          50    51     52   53    54    55    56    57    58    59    60

4.  1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1-----1
          60    61    62    63    64    65    66    67    68    69    70
```

5. 88　　6. 47　　7. 14　　8. 92　　9. 66　　10. 35

11. 27　　12. 75　　13. 99　　14. 31　　15. 73　　16. 127

17. 277　　18. 455　　19. 299

Enrichment:

Round these numbers to the nearest ten
a) 211,092
b) 4,247,755
c) 339,999

TOPIC 6: Base 2

Aim: How can we represent decimal numbers in base 2?

Performance Objectives: Students will be able to:

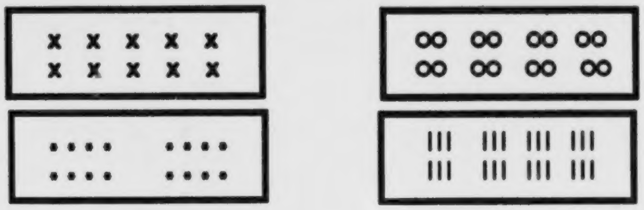
- identify number systems: base 10 and base 2
- calculate the place value numbers for base 2
- express base 10 numbers in base 2
- read numbers in base 2

Materials:

- Apple IIe lab
- software: Math Shop by Scholastic (also available for MS DOS computers)
- plastic connecting cubes
- chart tablet

Motivation:

Place the following on the chalkboard:
Ask students to group the items in the boxes by tens, fours, and twos.



Development:

1. Discuss the origins of the decimal system and the uses of the binary system. The ten fingers on the human hand made counting by hand a convenience. Computers use the binary system because its easier to represent on and off switches.

2. What are the place value numbers for the decimal system? How are these numbers obtained? What are the place value numbers for the binary system? How are these numbers obtained? Have students calculate the place value numbers for the binary system by doubling the numbers. i.e. double 1, double 2, double 4

3. Have a student draw the place value columns on the chalkboard as the rest of the class does so in their seats. Use the connecting cubes to represent the place values up to eight.

4. Ask students to use the place value table on the chalkboard to represent the following decimal numbers. Place a "Y" for yes if the place value number is needed and an "N" for no if the binary number is not needed. Use the connecting cubes to check the answers.

	8	4	2	1
1. 14	Y	Y	Y	N
2. 10				
3. 7				
4. 5				
5. 11				

5. The Dairy Shop in Math Shop will give the students added practice converting base 10 numbers to base 2. When the Math Shop program is loaded into the computers, students should move the worker to Dairy Shop. Press the space bar to enter the store.

6. Allow students ten to fifteen minutes to work in the Dairy Shop. Students should be allowed to work at their own pace.

7. After fifteen minutes or so, the teacher should call time. While the students were working on the computer, the place value table for the binary numbers should have been expanded to include the 64 and 32 place value columns. See diagram below.

Decimal	Binary						
	64	32	16	6	4	2	1
1 ______							1
2 ______						1	0
3 ______							
4 ______							
5 ______							
6 ______							
7 ______							
8 ______							
9 ______							
10 ______							

8. Ask students to place the number 1 if the place value number is needed to represent the number and a 0 in the column that is not needed. Complete two rows together with the students.

Summary:

1. How are binary numbers grouped?
2. What is the smallest number in the binary system?
3. What is the largest decimal number that can be represented by the binary place value numbers: 16, 8, 4, 2, 1?
4. What is the binary number for the following decimal numbers?

a. 25 __________ b. 16 ____________ c. 11 __________

Homework:

Express the given numbers in the binary system.

	Decimal	Binary
a.	100	
b.	35	
c.	fifteen	
d.	one dozen	
e.	days in a week	

Enrichment:

Create coded messages using binary place value numbers.

32 = H   8 = L   2 = O
16 = T   4 = E   1 = A

32 4 8 8 2   16 2   1 8 8

TOPIC 7: Exponents

Aim: How are exponents used to write very large and very small numbers?

Performance Objectives: The student will be able to:

- identify the base and the exponent
- explain the meaning of an exponent
- use exponent to write large numbers
- understand the relationship between exponents and square root

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra by Softwriters Development Corporation

Motivation:

Put the following table on the chalkboard:

Complete: Write numbers for d and e and give number of zeros needed for f and g.

a.	10 x 10	100
b.	10 x 10 x 10	1000
c.	10 x 10 x 10 x 10	10,000
d.	10 x 10 x 10 x 10 x 10	______________
e.	10 x 10 x 10 x 10 x 10 x 10 x 10 x 10	______________
f.	(10 x 10 x 10 ... x 10) 18 tens	________ zeros
g.	(10 x 10 x 10 ... x 10) 100 tens	________ zeros

Allow students a few minutes to complete table. How is a zero added to each number? How can two zeros be added to a number? What does the number of zeros tell about each number?

Development:

1. Suggest that there might be a shorter way to write numbers such as those in examples f and g. Write the numbers 10^{18} and 10^{100} on the board and label 10 as the base and 18 and 100 as the exponent. Elicit from students the concept that the base is the number which is multiplied, and the exponent the number of times it is used as a factor. Put 4^2 on the board. Have students name the base and the exponent and elicit the fact that it means 4 x 4.

2. Tell students that the program they are about to use will teach them more about exponents and show them how exponents and square roots are related.

3. Remind students of proper disk-handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise, have disk 4 ready to replace disk 1 when the program so instructs.

4. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. There will then be a choice of pretest or lesson; press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #14, and press RETURN. Follow

appropriate directions to load disk 4 and wait for lesson #14 to appear.

5. Students will first see several multiplication examples rewritten with exponents. The meaning of base and exponent will be shown and powers of 0 and 1 will be explained. The lesson also deals with the use of negative exponents and square roots of perfect squares. Then an eight-question quiz is given, followed by the student's raw score and percent correct.

6. Allow students about 10 minutes to complete the computer activity. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

7. Put the following on the board:
   750,000 = 700,000 + 50,000 = 7 x 100,000 + 5 x 10,000 = _______
   Elicit from students the exponential form for writing expanded notation. $(7 \times 10^5 + 5 \times 10^4)$

Summary:

1. What does the base number signify?
2. What does the exponent signify?
3. How are numbers which are written with exponents evaluated?
4. What does an exponent of 1 mean?
5. What does an exponent of 0 mean?
6. How are negative exponents used?
7. How is square root related to exponents?

Homework:

Prepare a rexographed sheet with 10-15 numbers written with exponents and have students find the value in standard numbers. Also include 10-15 standard numerals and have students convert to exponent form. (Use several different bases and include 1 and 0 as exponents); or make an appropriate assignment from the student text.

Enrichment:

Have students use an almanac or encyclopedia to look up the areas of ten countries and write the numbers in expanded notation using exponential form.

TOPIC 8: Scientific Notation Using Exponents

Aim: How are exponents used to write numbers in scientific notation?

Performance Objectives: The student will be able to:

- define scientific notation
- convert numbers written in scientific notation to standard numerals.
- write number in scientific notation using exponents

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra by Softwriters Development Corporation

Motivation:

Put the following table on the chalkboard:

Complete: Round each number to one non-zero digit. Write in exponent form.

7,804,000 = 8,000,000 = 8 x 1,000,000 = 8×10^6
27,000 = 30,000 = 3 x 10,000 = 3×10^4
847,692 = __________ = ______________ = ________
27,943,842 = __________ = ______________ = ________
93,000,000 = __________ = ______________ = ________

Allow several minutes for students to copy and complete table. If 8,000,000 = 8×10^6 and 9,000,000 = 9×10^6, what is the standard numeral for 8.7×10^6?

Development:

1. Tell students that the program they are about to use will define scientific notation and show how it can be used as a convenient method of expressing very large and very small quantities.

2. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise have disk 4 ready to replace disk 1 when the program so instructs.

3. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson; press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #15, and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #15 to appear.

4. The program begins with several examples of numbers in scientific notation with both positive and negative exponents. The rules are explained and the student is shown how to change numbers into scientific notation, first without exponents and then in the usual exponential form. The lesson concludes with a review of the rules, an eight-question quiz, and then gives the student's raw score and percent correct.

5. Allow the students 10-15 minutes to complete the computer activity. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

Summary:

1. What is the rule for writing a number in scientific notation?
2. How does an exponent indicate that a number has a value greater than one?
3. How does an exponent indicate that a number has a value less than one?
4. What is the effect on a number of first multiplying it and then dividing it by the same number?
5. Write a large number on the board and have students convert it to scientific notation.
6. Write a small number less than one on the board and have students convert it to scientific notation.

Homework:

Prepare a rexographed sheet with 10-20 numbers written in scientific notation (use both positive and negative exponents) and have students rewrite in standard form. Also give 10-20 numbers for students to write using scientific notation and exponent form (include both very large and very small numbers).

Enrichment:

Have students look up the diameters and average distances from the sun of the planets in this solar system and list them in both standard numerals and scientific notation.

TOPIC 9: Operations With Exponents

Aim: How can numbers written with exponents be multiplied and divided?

Performance Objectives: Students will be able to:

- multiply numbers in exponential form which have the same base
- divide numbers in exponential form which have the same base

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra by Softwriters Development Corporation

Motivation:

Put the following on the chalkboard:

Write the products in standard form, then rewrite both factors and products in exponent form, as shown:

$100 \times 10 = 1000$	$10{,}000 \quad 100 = 1000$
$10^2 \times 10^1 = 10^3$	$10^4 \quad 10^2 = 10^2$
$1000 \times 100 =$ ______	$100{,}000 \quad 1000 =$ ________
$10^3 \times 10^2 = 10$	$10^5 \quad 10^2 = 10$
$10{,}000 \times 10{,}000 =$ _______	$1{,}000{,}000 \quad 100 =$ ________
$10 \times 10 = 10$	$10 \quad 10 = 10$

Allow students several minutes to complete the table. What pattern appears in the multiplication examples? What pattern appears in the division examples? How would the product of $10^3 \times 10^5$ be written ? How about $3^3 \times 3^2$?

Development:

1. Tell students that the program they are about to use will demonstrate how to multiply and divide numbers which are written in exponent form.
2. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise have disk 4 ready to replace disk 1 when the program so instructs.
3. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson; press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #16, and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #16 to appear.
4. The students will first see completed multiplication and division examples using exponents. Then they will be shown that the bases must be the same and that the product is the same whether they multiply each factor or add the exponents, and the quotient is the same whether they

divide or subtract the exponents. The lesson conclude with a review, an eight-question quiz, the student's raw score and percent correct.

5. Allow student about 10 minutes to complete the computer activity. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

Summary:

1. How does the base affect operations with exponents?
2. What operations can be performed on numbers in exponent form?
3. What happens to the exponent in multiplication?
4. What happens to the exponent in division?
5. How are products and quotients found when numbers in exponent form have different bases?

Homework:

Prepare a rexographed sheet of 10 multiplication and 10 division examples with factors in exponent form. Have students give products and quotients in exponent form, then work out each example to show the same results, or make an appropriate assignment from the student text.

Enrichment:

Make copies of the following examples and challenge students to express each answer as a single power.

1. $2^2 \times 2^3 \times 2^5$
2. $4^0 \times 4 \times 4^2$
3. $a^3 \times a^5$
4. $b^6 \quad b^3$
5. $3^a \times 3^b$
6. $3^{-2} \times 3^7$
7. $(10^2)^3$
8. $(2^2)^3$

PART II

Addition of Whole Numbers

TOPIC 10: Adding Whole Numbers Without Regrouping

Aim: How do we add whole numbers without regrouping?

Performance Objectives: Student will be able to:

- add two 2-digit whole numbers without regrouping
- add two 3-digit whole numbers without regrouping
- add two 4-digit whole numbers without regrouping

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Soft Text: Math-Addition II by The Continental Press, Inc.

Motivation:

Harry has 24 baseball cards in his collection. Judy has 73 cards. How many cards do they have together?

Development:

1. Review with the students different addition facts that do not require regrouping. 1+0, 1+1, 1+2, 1+3, 1+4,..., 3+0, 3+1, 3+3, 3+4, ..., 8+0, 8+1, 9+0

2. Elicit from the students the answer to the motivation:

```
a) t o                                  b) t o
   e n                                     e n
   n e                                     n e
   s s                                     s s
   2 4                                     2 4
 + 7 3                                   + 7 3
 ------                                  ------
```

   a) Begin this example from the far right by adding the digits in the ones column first. 4 + 3 = 7
   b) Then add the digits in the tens column. 2 + 7 = 9
   c) Therefore, 24 + 73 = 97

3. Do this practice example with the students. Go through the procedure as shown in step 2a, b, and c.

```
a)    h                    b)    h                 c)    h
      u                          u                       u
      n                          n                       n
      d                          d                       d
      r t o                      r t o                   r t o
      e e n                      e e n                   e e n
      d n e                      d n e                   d n e
      s s s                      s s s                   s s s
      5 3 2                      5 3 2                   5 3 2
  +   1 4 6                  +   1 4 6               +   1 4 6
  ---------                  ---------               ---------
          8                        7 8                   6 7 8
```

4. Do this practice example with the students. Go through the procedure as shown in steps 2a, b, and c.

a) t
h h
o u
u n
s d
a r t o
n e e n
d d n e
s s s s

2 9 7 5
+ 3 0 1 4
9

b) t
h h
o u
u n
s d
a r t o
n e e n
d d n e
s s s s

2 9 7 5
+ 3 0 1 4
8 9

c) t
h h
o u
u n
s d
a r t o
n e e n
d d n e
s s s s

2 9 7 5
+ 3 0 1 4
9 8 9

d) t
h h
o u
u n
s d
a r t o
n e e n
d d n e
s s s s

2 9 7 5
+ 3 0 1 4
5 9 8 9

5. Tell the students that the program they are about to use will teach them to add two 2-digit, 3-digit, and 4-digit numbers without regrouping.

6. When the "Addition II" Disk is booted, a menu appears that lists four lessons. LESSON 1, LESSON 2, LESSON 3, and LESSON 4. Students should select LESSON 1, OBJECTIVE 2. After completing LESSON 1, OBJECTIVE 2, students should complete LESSON 1, OBJECTIVE 1; LESSON 2, OBJECTIVE 2; LESSON 2, OBJECTIVE 1; and LESSON 3, OBJECTIVE 1.

7. Before beginning an OBJECTIVE session, the student may choose to view how a problem is done. The student may also view the directions. If a student does an incorrect addition, the student is helped to achieve the correct answer.

Summary:

1. How do we add two 2-digit whole numbers without regrouping?
2. How do we add two 3-digit whole numbers without regrouping?
3. How do we add two 4-digit whole numbers without regrouping?

Homework:

1. 66
+ 23

2. 86
+ 13

3. 29
+ 70

4. 61
+ 33

5. 27
+ 51

6. 44
+ 22

7. 543
+ 236

8. 907
+ 62

9. 222
+ 345

10. 681
+ 208

11. 860
+ 129

12. 235
+ 462

13. 2624
+ 5353

14. 8003
+ 1742

15. 1987
+ 8011

16. 4455
+ 3344

17. 6006
+ 2332

18. 3994
+ 4005

19. 7211
+ 2118

20. 3066
+ 6033

Enrichment:

28,743
+ 41,022

986,654
+ 13,245

918,875,431
+ 51,114,352

TOPIC 11: Adding Whole Numbers With Regrouping In One Column Only

Aim: How do we add whole numbers with regrouping in one column only?

Performance Objectives: Students will be able to:

- add two 2-digit whole numbers with regrouping one column only
- add two 3-digit whole numbers with regrouping one column only
- add two 4-digit whole numbers with regrouping one column only

Materials:

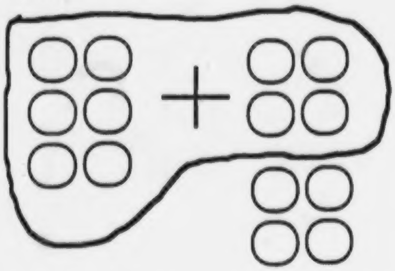
- Apple IIe or IIc, single disk drive, color or monochrome monitor
- Software: Soft Text: Math-Addition II by The Continental Press, Inc.

Motivation:

Joanne has 28 records in her record collection. Her brother Jack has 36 records. If they combined their collections, how many records would they have together?

Development:

1. Review with the students the method you use for regrouping 10-ones into 1 ten.



Our number system is called the decimal system. We group numbers in groups of ten. Therefore, as you can see in this picture, six + eight is the same as one group of ten and four left over.

$$6 + 8 = 14$$

2. Elicit from the students the answer to the motivation

```
b) t o                c) t o
   e n                   e n
   n e                   n e
   s s                   s s

   1                     1
   3 6                   3 6
 + 2 8                +  2 8
 -----                ------
     4                   6 4
```

a) Begin this example from the far right by adding the digits in the ones column first. 6 + 8 = 1 group of ten and 4 ones left over. Place the 4 ones in the ones answer column and carry the 1 group of ten in the tens column.
b) Then add the digits in the tens column. 3 + 2 + 1 = 6
c) Therefore, 36 + 28 = 64

3. Do this practice example with the students. Go through the procedure as shown in steps 2a, b, and c.

```
a)  t o             b) t o
    e n                e n
    n e                n e
    s s                s s

    8 6                8 6
  + 6 2             +  6 2
  -----             ------
      8              1 4 8
```

4. Do this practice example with the students. Go through the procedure as shown in step 2a, b, and c.

```
a)  t             b)  t              c)  t           d)  t
    h h               h h                h h             h h
    o u               o u                o u             o u
    u n               u n                u n             u n
    s d               s d                s d             s d
    a r t o           a r t o            a r t o         a r t o
    n e e n           n e e n            n e e n         n e e n
    d d n e           d d n e            d d n e         d d n e
    s s s s           s s s s            s s s s         s s s s

                        1                  1               1
    4 6 9 5           4 6 9 5            4 6 9 5         4 6 9 5
  + 2 2 6 3         + 2 2 6 3          + 2 2 6 3       + 2 2 6 3
  ---------         ---------          ---------       ---------
          8               5 8              9 5 8         6 9 5 8
```

5. Tell the students that the program they are about to use will teach them to add two 2-digit, 3-digit, and 4-digit whole numbers with regrouping one column only.

6. When the "Addition II" Disk is booted a menu appears that shows four examples; LESSON 1, LESSON 2, LESSON 3, LESSON 4. Students should select LESSON 1, OBJECTIVE 3. After completing LESSON 1, OBJECTIVE 3, students should complete LESSON 2, OBJECTIVE 3; LESSON 2, OBJECTIVE 4; LESSON 3, OBJECTIVE 2.

7. Before beginning an OBJECTIVE session, the student may choose to view how a problem is done. The student may also view the directions. If a student does an incorrect addition, the student is helped to achieve the correct answer.

Summary:

1. How do we add two 2-digit whole numbers with regrouping in one column only?
2. How do we add two 3-digit whole numbers with regrouping in one column only?
3. How do we add two 4-digit whole numbers with regrouping in one column only?

Homework:

```
1.  54          2.  35          3.  22          4.  91
  + 72            + 58            + 68            + 55
  ----            ----            ----            ----

5.  39          6.  86          7.  562         8.  872
  + 41            + 22            + 295           +  56
  ----            ----            -----           -----
```

9. 483
+ 272

10. 351
+ 933

11. 226
+ 539

12. 747
+ 422

13. 2333
+ 5482

14. 8003
+ 6986

15. 7343
+ 2922

16. 6736
+ 2109

17. 8457
+ 1491

18. 7734
+ 1965

19. 2929
+ 9040

20. 4944
+ 2933

Enrichment:

88,254
+ 11,082

241,547
+ 13,245

784,254,997
+ 13,194,002

TOPIC 12: Adding Whole Numbers With Regrouping in More than One Column

Aim: How do we add whole numbers with regrouping in more than one column?

Performance Objectives: Students will be able to:

- add two 2-digit whole numbers with regrouping in more than one column
- add two 3-digit whole numbers with regrouping in more than one column
- add two 4-digit whole numbers with regrouping in more than one column

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Soft Text: Math - Addition II by The Continental Press Inc.

Motivation:

There were 45 students sitting in the auditorium. If 79 students entered, how many students would be in the auditorium?

Development:

1. Elicit from the students the answer to the motivation:

```
a)   t o                   b    t o
     e n                        e n
     n e                        n e
     s s                        s s

     1                          1
     4 5                        4 5
  +  7 9                     +  7 9
  --------                   --------
       4                      1 2 4
```

a) Begin this example from the far right by adding the digits in the ones column first. 5 + 9 = 14; 1 group of ten and 4 ones left over. Place the 4 ones in the ones answer column and carry the 1 group of ten in the tens column.
b) Then add the digits in the tens column 4 + 7 + 1 = 12. Since there is no hundreds column the 12 can be placed in the answer.
c) Therefore, 45 + 79 = 124

2. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a)  h                b)  h                c)  h
    u                    u                    u
    n                    n                    n
    d                    d                    d
    r t o                r t o                r t o
    e e n                e e n                e e n
    d n e                d n e                d n e
    s s s                s s s                s s s

      1                    1                    1
    4 2 5                4 2 5                4 2 5
  + 7 5 7              + 7 5 7            +   7 5 7
  --------             --------           ----------
        2                  8 2              1 1 8 2
```

4. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

a)

	thousands	hundreds	tens	ones
			1	
	7	6	8	2
+	2	9	6	9
				1

b)

	thousands	hundreds	tens	ones
		1	1	
	7	6	8	2
+	2	9	6	9
			5	1

c)

	thousands	hundreds	tens	ones
	1	1	1	
	7	6	8	2
+	2	9	6	9
		6	5	1

d)

		thousands	hundreds	tens	ones
		1	1	1	
		7	6	8	2
+		2	9	6	9
	1	0	6	5	1

5. Tell the students that the program they are about to use will teach them to add two 2-digit, 3-digit, and 4-digit whole numbers with regrouping in more than one column.

6. When the "Addition II" Disk is booted a menu appears that shows four examples; LESSON 1, LESSON 2, LESSON 3, and, LESSON 4. Students should select LESSON 1, OBJECTIVE 4. After completing LESSON 1, OBJECTIVE 4, students should complete LESSON 2, OBJECTIVE 5, LESSON 3, OBJECTIVE 3.

7. After the students finish these exercises, the students should do the final OBJECTIVE in each LESSON. This is a review of the material in each LESSON. There is also a TEST section that should now be completed.

8. Before beginning an OBJECTIVE session, the student may choose to see how a problem is done. The student may also see the directions. If a student does an incorrect addition, the student is helped to achieve the correct answer.

Summary:

1. How do we add two 2-digit whole numbers with regrouping in more than one column?
2. How do we add two 3-digit whole numbers with regrouping in more than one column?
3. How do we add two 4-digit whole numbers with regrouping in more than one column?

Homework: See attached worksheet

Enrichment:

67,443 + 25,965

337,458 + 66,109

666,297,978 + 34,375,429

Homework Assignment:

1. 36 + 75
2. 57 + 66
3. 84 + 27
4. 39 + 77
5. 62 + 79
6. 99 + 42
7. 474 + 727
8. 670 + 762

9. $\begin{array}{r} 382 \\ +\ 729 \\ \hline \end{array}$

10. $\begin{array}{r} 228 \\ +\ 882 \\ \hline \end{array}$

11. $\begin{array}{r} 709 \\ +\ 394 \\ \hline \end{array}$

12. $\begin{array}{r} 767 \\ +\ 233 \\ \hline \end{array}$

13. $\begin{array}{r} 6336 \\ +\ 3777 \\ \hline \end{array}$

14. $\begin{array}{r} 5746 \\ +\ 2384 \\ \hline \end{array}$

15. $\begin{array}{r} 5385 \\ +\ 8338 \\ \hline \end{array}$

16. $\begin{array}{r} 8112 \\ +\ 1988 \\ \hline \end{array}$

17. $\begin{array}{r} 4442 \\ +\ 4677 \\ \hline \end{array}$

18. $\begin{array}{r} 9282 \\ +\ 2928 \\ \hline \end{array}$

19. $\begin{array}{r} 5638 \\ +\ 4744 \\ \hline \end{array}$

20. $\begin{array}{r} 9145 \\ +\ 5866 \\ \hline \end{array}$

TOPIC 13: Adding More Than Two Whole Numbers

Aim: How do we add more than two whole numbers?

Performance Objectives: Student will be able to:

- add more than two 2-digit whole numbers
- add more than two 3-digit whole numbers
- add more than two 4-digit whole numbers

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Soft Text: Math-Addition II by The Continental Press Inc.

Motivation:

Jane's basketball team held a practice session. The team scored 34 points, 6 points and 27 points during different portions of the practice session. How many points did the team score during the entire session?

Development:

1. Elicit from the students the answer to the motivatio:

a)

	tens	ones
	1	
	3	4
		6
+	2	7
		7

b)

	tens	ones
	1	
	3	4
		6
+	2	7
	6	7

a) Begin this example from the far right by adding the digits in the ones column first 4 + 6 + 7 = 1 group of ten and 7 ones left over. Place the 7 ones in the ones answer column and carry the 1 group of ten in the tens column.
b) Then add the digits in the tens column 3 + 2 + 1 = 6
c) Therefore, 34 + 6 + 27 = 67

2. Do this example with the students. Go through the procedure as shown in steps, 1a, b, c.

a)

	hundreds	tens	ones
		2	
	4	1	8
		6	7
+	2	6	6
			2

b)

	hundreds	tens	ones
	1	2	
	4	1	8
		6	7
+	2	6	6
		5	2

c)

	hundreds	tens	ones
	1	2	
	4	1	8
		6	7
+	2	6	6
	7	5	2

a) Begin this example from the far right by adding the digits in the ones column first. 8 + 8 + 6 = 2 groups of ten and 2 ones left over. Place the 2 ones in the ones answer column and carry the 2 groups of ten into the tens column.
b) Then add the digits in the tens column. 1 + 6 + 6 + 2 = 15. Place the 5 in the tens answer column and carry the 1 into the hundreds column.
c) Then add the digits in the hundreds column 4 + 2 + 1 = 7
d) Therefore, 418 + 68 + 266 = 752

3. Do this example with the students. Go through the procedure as shown in steps 1a, b, c.

a)

	hundreds	tens	ones
		1	
	2	9	4
	3	2	5
+	8	9	4
			3

b)

	hundreds	tens	ones
	2	1	
	2	9	4
	3	2	5
+	8	9	4
		1	3

c)

	hundreds	tens	ones
	2	1	
	2	9	4
	3	2	5
+	8	9	4
1	5	1	3

a) Begin this example from the far right by adding the digits in the ones column first. 4 + 5 + 4 = 13 Place the 3 ones in the ones answer column and carry the 1 into the tens column.
b) Then add the digits in the tens column. 9 + 2 + 9 + 1 = 21 Place the 1 in the tens answer column and carry the 2 into the hundreds column.
c) Then add the digits in the hundreds column. 2 + 3 + 8 + 2 = 15 Since there is no thousands column the 15 can be placed in the answer.
d) Therefore, 294 + 325 = 894 = 1513

4. Do this practice example with the students. Go through the procedure as shown in step 1a, b, c.

a)

	thousands	hundreds	tens	ones
			2	
	7	3	8	9
	2	9	4	8
+	4	4	4	4
				1

b)

	thousands	hundreds	tens	ones
		1	2	
	7	3	8	9
	2	9	4	8
+	4	4	4	4
			8	1

c)

	thousands	hundreds	tens	ones
	1	1	2	
	7	3	8	9
	2	9	4	8
+	4	4	4	4
		7	8	1

d)

	thousands	hundreds	tens	ones
	1	1	2	
	7	3	8	9
	2	9	4	8
+	4	4	4	4
1	4	7	8	1

Summary:

1. How do you add more than two 2-digit whole numbers?
2. How do you add more than two 3- digit whole numbers?
3. How do you add more than two 4-digit whole numbers?

Homework: See attached worksheet:

Enrichment:

7694	5496	3896
+ 3876	+ 7887	+ 4785

Homework Assignment:

1. 22
33
+ 44

2. 14
83
+ 22

3. 24
36
+ 27

4. 23
26
+ 41

5. 63
38
+ 22

6. 51
59
+ 26

7. 213
31
+ 425

8. 212
323
+ 125

9. 426
332
+ 591

10. 555
383
+ 474

11. 588
212
+ 388

12. 535
985
+ 125

13. 2312
1221
+ 2242

14. 6228
1223
+ 4114

15. 4732
8438
+ 2272

16. 3352
5491
+ 2259

17. 4224
55
253
+ 5877

18. 2668
6448
9373
+ 6508

19. 3355
7409
3811
+ 9939

20. 5377
6854
2899
+ 2323

PART III

Subtraction of Whole Numbers

TOPIC 14: Subtracting Two One-Digit Numbers

Aim: How can we subtract two 1-digit numbers?

Performance Objectives: Students will be able to:

- understand the concept of subtraction
- demonstrate the concept of subtraction using concrete objects such as: squared materials, blocks, chips, etc.
- calculate subraction using no concrete objects
- subtract a 1-digit number from another

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing co.
- concrete objects such as: coins, chips, etc.

Motivation:

Write the following on the chalkboard:

I have six pennies. I buy candy for three cents. How much do I have left?

$$\begin{array}{r} 6 \\ -\ 3 \\ \hline 3 \end{array}$$

Development:

1. After the motivation, reinforce the concept of subtraction with concrete objects. Encourage the students to use the objects in their calculations, but to record the data in the two standard forms:

   $5 - 3 = 2$ or $\begin{array}{r} 5 \\ -\ 3 \\ \hline 2 \end{array}$

2. Tell the students that the program they are about to use will teach them how to subtract without using objects.

3. Prior to bringing the class into the computer lab, the teacher must place initial information concerning the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH. (the screen displays XXXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The program is self loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally, there should be one computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 1 to 6 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. Three to five lessons are recommended for this skill, as it is an introductory one. Later in the term, review lessons at this level are essential to retain a mastery level.

Summary:

1. What does subtraction mean?
2. Using a pile of blocks, who can show what happens after subtracting one or more blocks?
3. Using coins, can someone demonstrate 7 - 3 ?
4. How much is 9 - 2 ?

Homework:

1. 9 - 1 = ___ 2. 4 - 2 = ___ 3. 9 - 4 = ___ 4. 3 - 1 = ___

5. 3 - 1 = ___ 6. 8 - 8 = ___ 7. 8 - 0 = ___ 8. 4 - 1 = ___

9. 7 - 2 = ___ 10. 3 - 0 = ___ 11. 9 - 8 = ___ 12. 3 - 0 = ___

13. 2 - 2 = ___ 14. 6 - 2 = ___ 15. 9 - 9 = ___ 16. 9 - 3 = ___
17. 9 - 5 = ___ 18. 4 - 1 = ___ 19. 4 - 0 = ___ 20. 9 - 2 = ___
21. 5 - 2 = ___ 22. 5 - 0 = ___ 23. 7 - 5 = ___ 24. 9 - 0 = ___
25. 7 - 4 = ___ 26. 6 - 4 = ___ 27. 9 - 6 = ___ 28. 8 - 2 = ___
29. 5 - 3 = ___ 30. 6 - 4 = ___

1. $\begin{array}{r}9\\-\ 9\\\hline\end{array}$ 2. $\begin{array}{r}3\\-\ 0\\\hline\end{array}$ 3. $\begin{array}{r}6\\-\ 5\\\hline\end{array}$ 4. $\begin{array}{r}1\\-\ 0\\\hline\end{array}$ 5. $\begin{array}{r}9\\-\ 8\\\hline\end{array}$

6. $\begin{array}{r}8\\-\ 5\\\hline\end{array}$ 7. $\begin{array}{r}2\\-\ 2\\\hline\end{array}$ 8. $\begin{array}{r}7\\-\ 5\\\hline\end{array}$ 9. $\begin{array}{r}3\\-\ 2\\\hline\end{array}$ 10. $\begin{array}{r}5\\-\ 0\\\hline\end{array}$

11. $\begin{array}{r}8\\-\ 3\\\hline\end{array}$ 12. $\begin{array}{r}6\\-\ 3\\\hline\end{array}$ 13. $\begin{array}{r}9\\-\ 0\\\hline\end{array}$ 14. $\begin{array}{r}2\\-\ 1\\\hline\end{array}$ 15. $\begin{array}{r}3\\-\ 1\\\hline\end{array}$

16. $\begin{array}{r}8\\-\ 0\\\hline\end{array}$ 17. $\begin{array}{r}4\\-\ 1\\\hline\end{array}$ 18. $\begin{array}{r}8\\-\ 2\\\hline\end{array}$ 19. $\begin{array}{r}7\\-\ 4\\\hline\end{array}$ 20. $\begin{array}{r}2\\-\ 1\\\hline\end{array}$

21. $\begin{array}{r}8\\-\ 8\\\hline\end{array}$ 22. $\begin{array}{r}8\\-\ 7\\\hline\end{array}$ 23. $\begin{array}{r}1\\-\ 1\\\hline\end{array}$ 24. $\begin{array}{r}9\\-\ 2\\\hline\end{array}$ 25. $\begin{array}{r}3\\-\ 0\\\hline\end{array}$

26. $\begin{array}{r}2\\-\ 0\\\hline\end{array}$ 27. $\begin{array}{r}9\\-\ 4\\\hline\end{array}$ 28. $\begin{array}{r}5\\-\ 3\\\hline\end{array}$ 29. $\begin{array}{r}9\\-\ 5\\\hline\end{array}$ 30. $\begin{array}{r}7\\-\ 0\\\hline\end{array}$

Enrichment:

If I have 30 pieces of candy, and I give one to all 30 children in the class, how many are left?

TOPIC 15: Subtracting a One-Digit Number From a Two-Digit Number

Aim: How can we subtract a one-digit number from a two-digit number?

Performance Objectives: Student will be able to:

- understand the concept of subtraction
- subtract a one-digit number from a two-digit number with regrouping using the expanded notation
- subtract a one-digit number from a two-digit number with regrouping tens for ones

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- concrete objects: chips, coins, sticks, etc.
- square material

Motivation:

Write the following on the chalkboard:

What did we have to do special when we subtracted:

$$\begin{array}{r} 14 \\ \underline{-\ \ 6} \end{array}$$

Take 14 chips and give them to one of the students. Now take 6 away. How much is left?

Now let's do the same thing with these sticks. Does anyone know why some of them are tied into a group of ten?
If I have one bundle of 10 sticks and 4 loose sticks, how many do I have now?

If 6 are lost, how many are left? Let's count out the sticks to show the 6 that are lost. Why can't we count out 6?

Let's see how we can calculate this problem without using sticks:

$$\begin{array}{r} 14 \\ \underline{-\ \ 6} \end{array}$$

Development:

1. After the motivation, reinforce the concept of subtraction with exchanges. Do a number of the exchange examples on the chalkboard. Using addition exchanges with missing addends to help illustrate the skill.

2. Tell the students that the program they are about to use will teach them how to subtract a one-digit number from a two-digit number.

3. Prior to bringing the class into the computer lab, the teacher must place certain information concerning the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. And when the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommmended that the management system not be used. The students will then sign into the system as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 7, 8, 13, 14, 15, 16, 17, 18, 19, 20, or 21 (which corresponds to today's lessons).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One session is recommended for this skill.

Summary: How do we subtract a one-digit number from a two-digit number?

Homework:

1. $\begin{array}{r} 16 \\ -\ \ 9 \\ \hline \end{array}$ 2. $\begin{array}{r} 13 \\ -\ \ 4 \\ \hline \end{array}$ 3. $\begin{array}{r} 11 \\ -\ \ 8 \\ \hline \end{array}$ 4. $\begin{array}{r} 12 \\ -\ \ 9 \\ \hline \end{array}$ 5. $\begin{array}{r} 13 \\ -\ \ 6 \\ \hline \end{array}$

6. $\begin{array}{r} 13 \\ -\ 9 \\ \hline \end{array}$ 7. $\begin{array}{r} 10 \\ -\ 7 \\ \hline \end{array}$ 8. $\begin{array}{r} 12 \\ -\ 5 \\ \hline \end{array}$ 9. $\begin{array}{r} 11 \\ -\ 2 \\ \hline \end{array}$ 10. $\begin{array}{r} 18 \\ -\ 9 \\ \hline \end{array}$

11. $\begin{array}{r} 17 \\ -\ 9 \\ \hline \end{array}$ 12. $\begin{array}{r} 10 \\ -\ 3 \\ \hline \end{array}$ 13. $\begin{array}{r} 10 \\ -\ 6 \\ \hline \end{array}$ 14. $\begin{array}{r} 16 \\ -\ 7 \\ \hline \end{array}$ 15. $\begin{array}{r} 13 \\ -\ 8 \\ \hline \end{array}$

16. $\begin{array}{r} 10 \\ -\ 9 \\ \hline \end{array}$ 17. $\begin{array}{r} 13 \\ -\ 7 \\ \hline \end{array}$ 18. $\begin{array}{r} 10 \\ -\ 2 \\ \hline \end{array}$ 19. $\begin{array}{r} 15 \\ -\ 3 \\ \hline \end{array}$ 20. $\begin{array}{r} 14 \\ -\ 7 \\ \hline \end{array}$

21. $\begin{array}{r} 10 \\ -\ 1 \\ \hline \end{array}$ 22. $\begin{array}{r} 15 \\ -\ 7 \\ \hline \end{array}$ 23. $\begin{array}{r} 10 \\ -\ 4 \\ \hline \end{array}$ 24. $\begin{array}{r} 15 \\ -\ 9 \\ \hline \end{array}$ 25. $\begin{array}{r} 11 \\ -\ 3 \\ \hline \end{array}$

26. $\begin{array}{r} 11 \\ -\ 9 \\ \hline \end{array}$ 27. $\begin{array}{r} 15 \\ -\ 6 \\ \hline \end{array}$ 28. $\begin{array}{r} 11 \\ -\ 7 \\ \hline \end{array}$ 29. $\begin{array}{r} 12 \\ -\ 8 \\ \hline \end{array}$ 30. $\begin{array}{r} 14 \\ -\ 6 \\ \hline \end{array}$

Enrichment:

$\begin{array}{r} 172 \\ -\ \ \ 6 \\ \hline \end{array}$ $\begin{array}{r} 185 \\ -\ \ \ 8 \\ \hline \end{array}$ $\begin{array}{r} 193 \\ -\ \ \ 9 \\ \hline \end{array}$ $\begin{array}{r} 178 \\ -\ \ \ 9 \\ \hline \end{array}$

TOPIC 16: Subtracting Two-Digit Numbers

Aim: How can we subtract one two-digit number from another?

Performance Objectives: Student will be able to:

- subtract one two-digit number from another
- arrange two-digit subtraction problems in columnar form
- draw upon previously learned one-digit subtraction

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- squared materials

Motivation: Write the following on the chalkboard:

1) $\begin{array}{r} 7 \\ -\ 3 \\ \hline 4 \end{array}$ 2) $\begin{array}{r} 5 \\ -\ 1 \\ \hline 4 \end{array}$ 3) $\begin{array}{r} 75 \\ -\ 31 \\ \hline \end{array}$

Every one look at #1 and 2 carefully. Can anyone figure out how to do #3?

Development:

1. After the motivation, present a short series of problems on the chalkboard
2. Further the students' understanding by the use of squared materials (ones and tens).
3. Tell the students that the program they are about to use will teach them how to subtract one two-digit number from another.
4. Prior to bringing the class into the computer lab, the teacher must place certain information concerning the class on the disk. Load the disk. When the Title Page appears, hold the "Control" key down and press the "I" key.
5. Select option A "ADD A CLASS?". The screen prompts "NAME OF TEACHER TO ADD?". Use MATH for the teacher's name. The screen the prompts "CLASS NAME?"; again select MATH. Then the screen prompts "PASSWORD"; again select MATH (the screen displays xxxxxxxxx).
6. Finally, select option B - RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.
7. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.
8. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for class number, the students should input 1. When the screen prompts for a password, the students will input MATH.
9. Ideally each student has a computer. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the

teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #8), and work on one skill area only. The system will not retain records of the work.

10. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 23 (which corresponds to today's lesson).

11. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic display congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen gives the student the correct answer, and then goes on to the next problem.

12. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

13. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

14. One or two sessions are adequate. The second session can be used less as a group lesson, and more tailored to an individual's needs. The teacher can now use different levels for each group (based on their levels of ability), to review the current skill.

Summary:

1. What is the difference between 35 and 21?
2. How can we use $\begin{array}{r} 7 \\ -\ 4 \\ \hline 3 \end{array}$ and $\begin{array}{r} 4 \\ -\ 2 \\ \hline 2 \end{array}$ to help solve $\begin{array}{r} 74 \\ -\ 42 \\ \hline \end{array}$?
3. How can we rewrite 85-34 to make it easier to solve?

Homework:

The homework for this lesson can be generated by the management system itself. Insert the Worksheet Generator disk into a computer connected to a printer. This disk is self-loading. The teacher must select the skill area (i.e. subtraction), the level number (#23 which corresponds to today's lesson), and the number of problems desired. The computer will then generate a formatted homework sheet based on printer, the teacher then has a professionally-created homework ditto.

Enrichment:

1. Using the skills learned on two-digit subtraction solve:

$\begin{array}{r} 566 \\ -\ 324 \\ \hline \end{array}$ $\begin{array}{r} 583 \\ -\ 421 \\ \hline \end{array}$ $\begin{array}{r} 459 \\ -\ 254 \\ \hline \end{array}$

2. Rewrite and solve: 848 - 713.

Subtraction Sequence 23

Name ______________________________ Date ____________________________

1. 88 - 65
2. 92 - 52
3. 57 - 42
4. 98 - 48
5. 97 - 32
6. 67 - 55
7. 72 - 40
8. 78 - 25
9. 79 - 25
10. 62 - 60
11. 98 - 28
12. 48 - 35
13. 87 - 55
14. 96 - 94
15. 28 - 22
16. 65 - 62
17. 65 - 65
18. 98 - 34
19. 44 - 31
20. 49 - 22
21. 77 - 24
22. 59 - 44
23. 75 - 72
24. 36 - 21
25. 66 - 25
26. 88 - 85
27. 52 - 22
28. 86 - 42
29. 97 - 33
30. 45 - 30

TOPIC 17: Subtracting a One-Digit Number From a Two-Digit Number With Regrouping

Aim: How can we subtract a one-digit number from a two-digit number?

Performance Objectives: Students will be able to:

- subtract a one-digit number from a two-digit number with regrouping tens to ones (using the expanded notation)
- subtract a one-digit number from a two-digit number with regrouping tens to ones

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- squared material
- concrete objects: chips, markers, sticks

Motivation: Write the following on the chalkboard:

How can we solve $\begin{array}{r} 34 \\ \underline{-\ \ 8} \end{array}$?

Here we have three bundles of ten sticks, and four loose ones. Can someone come up and take 8 sticks? (Use any concrete object) Use scissors with squared materials.

After these demonstrations, use the expanded notation:

$$\begin{array}{rcrcr} 34 & = & 3\text{ tens} & + & 4\text{ ones} \\ \underline{-\ \ 8} & = & & - & 8\text{ ones} \\ \cline{3-5} \end{array}$$

We can then change the expanded notation to:

$$\begin{array}{rcrcl} 2\text{ tens} & + & 14\text{ ones} & & \\ & - & 8\text{ ones} & & \\ \hline 2\text{ tens} & + & 6\text{ ones} & = & 26 \end{array}$$

Development:

1. After the motivation, demonstrate how the use of expanded notation can be used to solve these problems. Demonstrate how the expanded notation can be bypassed.

2. Tell the students that the program they are about to use will teach them how to subtract a one-digit number from a two-digit number with regrouping.

3. Prior to bringing the class into the computer lab, the teacher must place certain information concerning the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enter the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommmended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the sustem, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 24 or 25 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses and the percentage.

13. One to two sessions are recommended.

Summary:

1. Solve $\begin{array}{r} 32 \\ \underline{-\ \ 6} \end{array}$ using expanded notation.

2. Solve $\begin{array}{r} 36 \\ \underline{-\ \ 8} \end{array}$

Homework:

1. $\begin{array}{r} 52 \\ \underline{-\ \ 9} \end{array}$ 2. $\begin{array}{r} 61 \\ \underline{-\ \ 4} \end{array}$ 3. $\begin{array}{r} 44 \\ \underline{-\ \ 8} \end{array}$ 4. $\begin{array}{r} 22 \\ \underline{-\ \ 5} \end{array}$ 5. $\begin{array}{r} 52 \\ \underline{-\ \ 6} \end{array}$

6. $\begin{array}{r} 32 \\ \underline{-\ 9} \end{array}$ 7. $\begin{array}{r} 31 \\ \underline{-\ 2} \end{array}$ 8. $\begin{array}{r} 70 \\ \underline{-\ 1} \end{array}$ 9. $\begin{array}{r} 64 \\ \underline{-\ 7} \end{array}$ 10. $\begin{array}{r} 63 \\ \underline{-\ 7} \end{array}$

11. $\begin{array}{r} 41 \\ \underline{-\ 6} \end{array}$ 12. $\begin{array}{r} 42 \\ \underline{-\ 4} \end{array}$ 13. $\begin{array}{r} 33 \\ \underline{-\ 4} \end{array}$ 14. $\begin{array}{r} 62 \\ \underline{-\ 6} \end{array}$ 15. $\begin{array}{r} 85 \\ \underline{-\ 9} \end{array}$

16. $\begin{array}{r} 50 \\ \underline{-\ 1} \end{array}$ 17. $\begin{array}{r} 73 \\ \underline{-\ 4} \end{array}$ 18. $\begin{array}{r} 41 \\ \underline{-\ 7} \end{array}$ 19. $\begin{array}{r} 85 \\ \underline{-\ 8} \end{array}$ 20. $\begin{array}{r} 30 \\ \underline{-\ 4} \end{array}$

21. $\begin{array}{r} 62 \\ \underline{-\ 5} \end{array}$ 22. $\begin{array}{r} 81 \\ \underline{-\ 4} \end{array}$ 23. $\begin{array}{r} 31 \\ \underline{-\ 9} \end{array}$ 24. $\begin{array}{r} 71 \\ \underline{-\ 5} \end{array}$ 25. $\begin{array}{r} 48 \\ \underline{-\ 9} \end{array}$

26. $\begin{array}{r} 90 \\ \underline{-\ 2} \end{array}$ 27. $\begin{array}{r} 78 \\ \underline{-\ 9} \end{array}$ 28. $\begin{array}{r} 70 \\ \underline{-\ 4} \end{array}$ 29. $\begin{array}{r} 30 \\ \underline{-\ 6} \end{array}$ 30. $\begin{array}{r} 34 \\ \underline{-\ 6} \end{array}$

Enrichment:

Solve:

1) $\begin{array}{r} 92 \\ \underline{-\ 7} \end{array}$ 2) $\begin{array}{r} 41 \\ \underline{-\ 23} \end{array}$ 3) $\begin{array}{r} 98 \\ \underline{-\ 7} \end{array}$ 4) $\begin{array}{r} 65 \\ \underline{-\ 9} \end{array}$

TOPIC 18: Subtracting Two Two-Digit Numbers With Regrouping

Aim: How can we subtract with regrouping?

Performance Objectives: Students will be able to:

- subtract a two-digit number from a two-digit number with regrouping tens to ones (using the expanded notation)
- subtract a two-digit number from a two-digit number with regrouping tens to ones

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- concrete objects: chips, markers, sticks

Motivation: Write the following on the chalkboard:

How can we solve $\begin{array}{r} 34 \\ \underline{-\ 18} \end{array}$?

Here we have three bundles of ten sticks, and four loose ones. Can someone come up and take 18 sticks? (use any concrete object)

After this demonstration, use the expanded notation:

$$\begin{array}{rcl} 34 & = & 3 \text{ tens} + 4 \text{ ones} \\ \underline{-\ 18} & = & \underline{1 \text{ tens} - 8 \text{ ones}} \end{array}$$

We can then change the expanded notation to:

$$\begin{array}{l} 2 \text{ tens} + 14 \text{ ones} \\ \underline{1 \text{ tens} - \ 8 \text{ ones}} \\ 1 \text{ tens} + \ 6 \text{ ones} \ = 16 \end{array}$$

Development:

1. After the motivation, demonstrate how the use of expanded notation can be used to solve problems. Demonstrate how the expanded notation can be bypassed.

2. Tell the students that the program they are about to use will teach them how to subtract a two-digit number from a two-digit number with regrouping.

3. Prior to bringing the class into the computer lab, the teacher must place certain information concerning the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. When the screen prompts for a class number, the students will input MATH.

8. Ideally there should be one computer for each student. Most classes however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 26 or 27 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem; the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate master, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of the day's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One to two sessions are recommended.

Summary:

Ask the students to:

1. Solve $\begin{array}{r} 32 \\ -\ 16 \\ \hline \end{array}$ using expanded notation.

2. Solve $\begin{array}{r} 36 \\ -\ 28 \\ \hline \end{array}$

Homework:

1. 94 - 38	2. 95 - 48	3. 83 - 66	4. 84 - 27	5. 82 - 59
6. 70 - 63	7. 86 - 59	8. 97 - 49	9. 56 - 39	10. 92 - 33
11. 83 - 38	12. 91 - 63	13. 53 - 26	14. 45 - 38	15. 74 - 46
16. 76 - 28	22. 97 - 48	23. 55 - 48	24. 71 - 33	25. 94 - 76

Enrichment:

Solve:

1) 92 - 87	2) 41 - 33	3) 98 - 27	4) 65 - 59

TOPIC 19: Subtracting Two Three-Digit Numbers With No Regrouping

Aim: How can we subtract one three-digit number from another?

Performance Objectives: Students will be able to:

- subtract one three-digit number from another
- arrange three-digit subtraction problems in columnar form
- draw upon previously learned two-digit subtraction

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- squared materials

Motivation:

Write the following on the chalkboard:

$$1)\ \begin{array}{r} 7 \\ \underline{-\ 3} \\ 4 \end{array} \qquad 2)\ \begin{array}{r} 5 \\ \underline{-\ 1} \\ 4 \end{array} \qquad 3)\ \begin{array}{r} 8 \\ \underline{-\ 3} \\ 5 \end{array} \qquad 4)\ \begin{array}{r} 75 \\ \underline{-31} \\ 44 \end{array} \qquad 5)\ \begin{array}{r} 758 \\ \underline{-313} \end{array}$$

Everyone look at #1, 2, 3, and 4 carefully. Can anyone figure out how to do #5?

Development:

1. After the motivation, present a short series of problems on the chalkboard.

2. Further the students' understanding by the use of squared materials (ones, tens, hundreds).

3. Tell the students that the program they are about to use will teach them how to subtract one three-digit number from another.

4. Prior to bringing the class into the computer lab, the teacher must enter certain information to prepare the disk for use. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

5. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

6. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

7. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

8. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name: the students will input MATH. When the screen prompts for a class number, the students input 1, and when the screen prompts for a password, the students will input MATH.

9. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #8), and work on one skill area only. The system will not retain records of the work.

10. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 32 (which corresponds to today's lesson).

11. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

12. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

13. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

14. One or two sessions is adequate. The second session can be used less as a group lesson, and more tailored to tbe individual's needs. The teacher can now use different levels for each group (as per their ability), to review the current skill.

Summary:

1. What is the difference between 935 and 421?
2. How can we rewrite 585-234 to make it easier to solve?
3. How can we use $\begin{array}{r} 87 \\ \underline{-25} \end{array}$ to help solve $\begin{array}{r} 587 \\ \underline{-325} \end{array}$?

Homework:

The homework for this lesson can be generated by the management system itself. Insert the Worksheet Generator disk into a disk drive, connected to a computer and a printer. The disk is self-loading. The teacher must select the skill area (i.e. subtraction), the level number (#32, which corresponds to today's lesson), and the number of problems desired. The computer will then generate a formatted homework sheet based on the previously entered information. If a rexo is placed in the printer, the teacher then has a professionally-created homework ditto.

Enrichment:

1. Using the lesson on three-digit subtraction solve:

4756	5758	9457
-2342	-2342	-7252

2. Rewrite and solve: 4848 - 2713.

WORKSHEET

Name ______________________________ Date ____________________

1. 696 -522	2. 445 -342	3. 845 -722	4. 866 -661	5. 282 -151
6. 682 -150	7. 977 -165	8. 577 -225	9. 748 -402	10. 797 -614
11. 898 -192	12. 798 -616	13. 928 -623	14. 775 -571	15. 668 -164
16. 883 -742	17. 827 -327	18. 964 -641	19. 844 -204	20. 991 -141
21. 496 -364	22. 799 -442	23. 778 -616	24. 794 -472	25. 792 -690
26. 858 -524	27. 762 -561	28. 752 -540	29. 652 -531	30. 698 -473

ANSWERS

1. $\begin{array}{r} 696 \\ -522 \\ \hline 174 \end{array}$	2. $\begin{array}{r} 445 \\ -342 \\ \hline 103 \end{array}$	3. $\begin{array}{r} 845 \\ -722 \\ \hline 123 \end{array}$	4. $\begin{array}{r} 866 \\ -661 \\ \hline 205 \end{array}$	5. $\begin{array}{r} 282 \\ -151 \\ \hline 131 \end{array}$
6. $\begin{array}{r} 682 \\ -150 \\ \hline 532 \end{array}$	7. $\begin{array}{r} 977 \\ -165 \\ \hline 812 \end{array}$	8. $\begin{array}{r} 577 \\ -225 \\ \hline 352 \end{array}$	9. $\begin{array}{r} 748 \\ -402 \\ \hline 346 \end{array}$	10. $\begin{array}{r} 797 \\ -614 \\ \hline 183 \end{array}$
11. $\begin{array}{r} 898 \\ -192 \\ \hline 506 \end{array}$	12. $\begin{array}{r} 798 \\ -616 \\ \hline 182 \end{array}$	13. $\begin{array}{r} 928 \\ -623 \\ \hline 305 \end{array}$	14. $\begin{array}{r} 775 \\ -571 \\ \hline 204 \end{array}$	15. $\begin{array}{r} 668 \\ -164 \\ \hline 504 \end{array}$
16. $\begin{array}{r} 883 \\ -742 \\ \hline 141 \end{array}$	17. $\begin{array}{r} 827 \\ -327 \\ \hline 500 \end{array}$	18. $\begin{array}{r} 964 \\ -641 \\ \hline 323 \end{array}$	19. $\begin{array}{r} 844 \\ -204 \\ \hline 640 \end{array}$	20. $\begin{array}{r} 991 \\ -141 \\ \hline 850 \end{array}$
21. $\begin{array}{r} 496 \\ -364 \\ \hline 132 \end{array}$	22. $\begin{array}{r} 799 \\ -442 \\ \hline 357 \end{array}$	23. $\begin{array}{r} 778 \\ -616 \\ \hline 162 \end{array}$	24. $\begin{array}{r} 794 \\ -472 \\ \hline 322 \end{array}$	25. $\begin{array}{r} 792 \\ -690 \\ \hline 102 \end{array}$
26. $\begin{array}{r} 858 \\ -524 \\ \hline 334 \end{array}$	27. $\begin{array}{r} 762 \\ -561 \\ \hline 241 \end{array}$	28. $\begin{array}{r} 752 \\ -540 \\ \hline 212 \end{array}$	29. $\begin{array}{r} 652 \\ -531 \\ \hline 121 \end{array}$	30. $\begin{array}{r} 698 \\ -473 \\ \hline 225 \end{array}$

TOPIC 20: Subtracting Two Three-Digit Numbers With Regrouping

Aim: How can we subtract 174 from 438?

Performance Objectives: Students will be able to:

- subtract a three-digit number from a three-digit number with regrouping hundreds to tens (using the expanded notathon)
- subtract a three-digit number from a three-digit number with regrouping hundreds to tens

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- squared materials

Motivation:

Write the following on the chalkboard:

How can we solve 738
- 184

Use the expanded notation:

738 = 7 hundreds + 3 tens + 8 ones
- 184 = 1 hundred - 8 tens - 4 ones

We can then change the expanded notation to:

6 hundreds + 13 tens + 8 ones
- 1 hundred - 8 tens - 4 ones
5 hundreds + 4 tens + 8 ones = 554

Development:

1. After the motivation, demonstrate how the use of expanded notation can be used to solve these problems. Demonstrate how the expanded notation can be bypassed.

2. Tell the students that the program they are about to use will teach them how to subtract a three-digit number from a three-digit number, with regrouping two times.

3. Prior to bringing the class into the computer lab, the teacher must enter certain information to prepare the disk for use. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on

the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name: the students will input MATH. When the screen prompts for a class number, the students input 1, and when the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 33 to 35 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One to two sessions are recommended.

Summary:

1. Solve $\begin{array}{r} 450 \\ \underline{-160} \end{array}$ using expanded notation.

2. Solve $\begin{array}{r} 807 \\ \underline{-285} \end{array}$

Homework: See attached homework sheet

Enrichment:

Solve:

1. $\begin{array}{r} 1007 \\ \underline{-875} \end{array}$ 2. $\begin{array}{r} 1004 \\ \underline{-333} \end{array}$ 3. $\begin{array}{r} 1009 \\ \underline{-274} \end{array}$ 4. $\begin{array}{r} 1001 \\ \underline{-599} \end{array}$

WORKSHEET

Name ______________________________ Date ____________________

1. $\begin{array}{r} 950 \\ \underline{-\ 103} \end{array}$	2. $\begin{array}{r} 893 \\ \underline{-\ 255} \end{array}$	3. $\begin{array}{r} 960 \\ \underline{-\ 507} \end{array}$	4. $\begin{array}{r} 640 \\ \underline{-\ 326} \end{array}$	5. $\begin{array}{r} 531 \\ \underline{-\ 329} \end{array}$
6. $\begin{array}{r} 970 \\ \underline{-\ 751} \end{array}$	7. $\begin{array}{r} 893 \\ \underline{-\ 585} \end{array}$	8. $\begin{array}{r} 795 \\ \underline{-\ 43} \end{array}$	9. $\begin{array}{r} 671 \\ \underline{-\ 547} \end{array}$	10. $\begin{array}{r} 724 \\ \underline{-\ 219} \end{array}$
11. $\begin{array}{r} 835 \\ \underline{-\ 229} \end{array}$	12. $\begin{array}{r} 454 \\ \underline{-\ 216} \end{array}$	13. $\begin{array}{r} 827 \\ \underline{-\ 608} \end{array}$	14. $\begin{array}{r} 770 \\ \underline{-\ 341} \end{array}$	15. $\begin{array}{r} 970 \\ \underline{-\ 539} \end{array}$
16. $\begin{array}{r} 971 \\ \underline{-\ 332} \end{array}$	17. $\begin{array}{r} 692 \\ \underline{-\ 189} \end{array}$	18. $\begin{array}{r} 1000 \\ \underline{-\ 227} \end{array}$	19. $\begin{array}{r} 860 \\ \underline{-\ 415} \end{array}$	20. $\begin{array}{r} 688 \\ \underline{-\ 359} \end{array}$

WORKSHEET

Name ______________________________ Date ____________________

1. 536 -475

2. 494 -337

3. 914 -205

4. 478 -283

5. 546 -466

6. 873 -406

7. 933 -718

8. 531 -422

9. 794 -275

10. 418 -325

11. 728 -409

12. 719 -189

13. 318 -230

14. 942 -419

15. 957 -685

16. 292 -147

17. 973 -438

18. 618 -352

19. 937 -353

20. 571 -381

TOPIC 21: Subtracting Using Missing Addends

Aim: How can we use addition facts to help with subtraction?

Performance Objectives: Students will be able to:

- understand the concept of subtraction
- utilize missing addends to solve subtraction problems

Vocabulary: addends

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.

Motivation:

Write the following on the chalkboard:

6 - 4 = ?   4 + ? = 6   How can the addition fact help solve the subtraction fact?

5 + 2 = 7   7 - 5 = 2   What do you notice about these number sentences?

Use 7 + 1 = 8 to solve: 8 - 7 = ?
8 - 1 = ?

Development:

1. After the motivation, reinforce the concept of subtraction by using addition problems with missing addends. Relate them back to the subtraction problems.

2. Tell the students that the program they are about to use will teach them how to subtract using addition problems.

3. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD?. use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. And when screen prompts for a password, the students will input MATH.

8. Ideally, there should be one computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, **REVIEW SEQUENCE AS A STUDENT**. Then instruct them to select option A, **ANIMATION**. When the screen prompts **BEGINNING LEVEL?**, the students are to input 9 or 10 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts **PRESS RETURN**, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until either they demonstrate mastery or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One session is recommended for this skill.

Summary:

1. What does subtraction mean?
2. To solve 9 - 2 = ?, what addition fact can be used?

Homework:

See attached homework sheet.

Enrichment:

9 + ____ = 17   8 - ____ = 1   10 - ____ = 2

TOPIC 22: Subtracting With a Missing Minuend

Aim: How can we subtract with a missing minuend?

Performance Objectives: Student will be able to:

- solve a subtraction problem with a missing minuend (10 through 18) and subtrahends 0 through 9, using addition number sentences
- solve a subtraction problem with a missing minuend (10 through 18) and subtrahends 0 through 9

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.

Motivation: Write the following on the chalkboard:

1) 14 - 3 = 11
2) 14 - 11 = 3
3) 11 + 3 = 14
4) 3 + 11 = 14

What do we call these number sentences? How can we use the number sentence families to solve other problems?

If 5 + 3 = 8, what is 8 - 5 = ?
If 4 + 12 = 16, what is 16 - 4 = ?
If 5 + 11 = 16, solve X - 5 = 11

Development:

1. After the motivation, reinforce the concept of finding missing minuends through addition. Continue to do a number of problems on the chalkboard.

2. Tell the students that the program they are about to use will teach them how to find missing minuends.

3. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self loading.

7. When the Title Page appears, tell the students to press the RETURN key. When the screen prompts for a class number, the students input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally, there should be a computer for each student. Most classes however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the

teacher. If a one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, **REVIEW SEQUENCE AS A STUDENT**. Then instruct them to select option A, **ANIMATION**. When the screen prompts BEGINNING LEVEL?, the students are to input 22 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes onto the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One to two sessions are recommended.

Summary:

1. If 12 + 5 = 17, solve: X - 5 = 12
2. Solve: X - 4 = 11

Homework:

SUBTRACTION SEQUENCE 22

NAME ______________________ DATE __________________

1. ___ - 9 = 3 2. ___ - 4 = 6 3. ___ - 9 = 0 4. ___ - 6 = 8

5. ___ - 8 = 4 6. ___ - 7 = 7 7. ___ - 7 = 4 8. ___ - 5 = 6

9. ___ - 7 = 5 10. ___ - 5 = 5 11. ___ - 5 = 8 12. ___ - 5 = 7

13. ___ - 3 = 9 14. ___ - 8 = 9 15. ___ - 9 = 2 16. ___ - 1 = 9

17. ___ - 6 = 5 18. ___ - 4 = 9 19. ___ - 3 = 7 20. ___ - 6 = 6

21. ___ - 9 = 9 22. ___ - 7 = 3 23. ___ - 5 = 1 24. ___ - 7 = 8

25. ___ - 6 = 9 26. ___ - 7 = 1 27. ___ - 9 = 7 28. ___ - 6 = 4

29. ___ - 7 = 8 30. ___ - 5 = 9

ENRICHMENT:

1) If 42 + 23 = 65, solve: X - 42 = 23
2) If 234 + 213 = 447, solve: X - 234 = 213
3) If 3,145 + 2,621 = 5,766, solve: X - 3,145 = 2,621

SUBTRACTION SEQUENCE

NAME ______________________ DATE ______________

1. 10 - ___ = 8
2. 9 - ___ = 6
3. 8 - ___ = 2
4. 7 - ___ = 5
5. 6 - ___ = 6
6. 10 - ___ = 9
7. 1 - ___ = 9
8. 10 - ___ = 8
9. 10 - ___ = 7
10. 10 - ___ = 10
11. 9 - ___ = 4
12. 7 - ___ = 7
13. 6 - ___ = 6
14. 8 - ___ = 0
15. 5 - ___ = 4
16. 6 - ___ = 1
17. 10 - ___ = 6
18. 8 - ___ = 1
19. 9 - ___ = 7
20. 8 - ___ = 3
21. 4 - ___ = 1
22. 1 - ___ = 0
23. 9 - ___ = 2
24. 8 - ___ = 8
25. 5 - ___ = 5
26. 6 - ___ = 3
27. 10 - ___ = 5
28. 8 - ___ = 7
29. 8 - ___ = 4
30. 10 - ___ = 0

PART IV

Multiplication of Whole Numbers

TOPIC 23: Multiplying Whole Numbers by a One-Digit Number Without Regrouping

Aim: How do we multiply whole numbers by a one-digit number without regrouping?

Performance Objectives: Student will be able to:

- multiply a two-digit whole number by a one-digit number without regrouping
- multiply a three-digit whole number by a one-digit number without regrouping
- multiply a four-digit whole number by a one-digit number without regrouping

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math-Multiplication II by The Continental Press Inc.

Motivation:

Three classes from our school went on a trip. Each class had 23 students. How many students went on the trip?

Development:

1. Review with the students the multiplication facts that do not require regrouping. 1x0, 1x1, 1x2, 1x3,..., 2x0, 2x1, 2x3, 2x4, 3x0, 3x1, 3x2, 3x3,...

2. Elicit from the students the answer to the motivation:

```
a)  t o                  b)  t o
    e n                      e n
    n e                      n e
    s s                      s s

    2 3                      2 3
 x    3                   x    3
 ------                   ------
      9                      6 9
```

a) Begin this example from the far right by multiplying the digit in the ones column by the multiplier 3 x 3 = 9

b) Then multiply the digit in the tens column by the multiplier 2 x 3 = 6

c) Therefore, 23 x 3 = 69

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a) h             b) h             c) h
   u                u                u
   n                n                n
   d                d                d
   r t o            r t o            r t o
   e e n            e e n            e e n
   d n e            d n e            d n e
   s s s            s s s            s s s

   4 2 4            4 2 4            4 2 4
x      2         x      2         x      2
--------         --------         --------
       8              4 8            8 4 8
```

4. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

a)

	thousands	hundreds	tens	ones
	3	0	1	2
x				3

b)

	thousands	hundreds	tens	ones
	3	0	1	2
x				3

c)

	thousands	hundreds	tens	ones
	3	0	1	2
x				3

d)

	thousands	hundreds	tens	ones
	3	0	1	2
x				3

5. Tell the students that the program they are about to use will teach them how to multiply a two-digit, three-digit, and four-digit whole number by a one-digit number without regrouping.

6. When the "Multiplication II" Disk is booted a menu appears that shows a choice of four lessons. Students should select LESSON 1, OBJECTIVE 2. After completing LESSON 1, OBJECTIVE 2, students should complete LESSON 3, OBJECTIVE 2.

7. Before beginning an OBJECTIVE session, the student may choose to view how a problem is done. The student may also view the directions. If a student makes an error, the student is helped to achieve the correct answer.

Summary:

1. How do we multiply a two-digit whole number by a one-digit number without regrouping?
2. How do we multiply a three-digit whole number by a one-digit number without regrouping?
3. How do we multiply a four-digit whole number by a one-digit number without regrouping?

Homework:

1 . 23
x 3

2. 42
x 2

3. 11
x 5

4. 34
x 2

5. 95
x 1

6. 44
x 2

7. 212
x 4

8. 13
x 3

9. 222
x 4

10. 332
x 2

11. 908
x 1

12. 231
x 3

13. 2324
x 2

14. 2003
x 3

15. 1101
x 8

16. 4434
x 2

17. 4112
x 2

18. 3994
x 1

19. 1001
x 6

20. 3022
x 3

Enrichment:

23,432
x 2

322,223
x 3

130,413,444
x 2

TOPIC 24: Multiplying Two-Digit Numbers Without Regrouping

Aim: How do we multiply two two-digit numbers without regrouping?

Performance Objectives: Student will be able to:

- multiply two-digit numbers without regrouping
- multiply two-digit numbers by 10

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math-Multiplication II by The Continental Press Inc.

Motivation:

Alan collected baseball cards. He bought 34 cards a month for 12 months. How many cards did he collect after the 12 months?

Development:

1. Elicit from the students the answer to the motivation:

```
a)  34        b)  34        c)   34        d)   34        e)   34
  x 12          x 12           x 12           x 12           x 12
  ----          ----           ----           ----           ----
     8            68             68             68             68
                                 4             34             34
                                                             ----
                                                             408
```

   a) Begin this example from the far right by multiplying the digit in the ones column by the ones digit of the multiplier. 4 x 2 = 8

   b) Then multiply the digit in the tens column by the ones digit of the multiplier 3 x 2 = 6

   c) Now multiply the digit in the ones column by the tens digit of the multiplier. 4 x 1 = 4 Line up the 4 under the tens digit of the multiplier in the answer as shown.

   d) Then multiply the digit in the tens column by the tens digit of the multiplier. 3 x 1 = 3

   e) Add the products as illustrated. Therefore 34 x 12 = 408

2. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, c, d and e.

```
a)  21        b)  21        c)  21        d)   21        e)  21
  x 24          x  24         x 24           x 24          x 24
  ----          -----         ----           ----          ----
     4             84           84             84            84
                                2             42            42
                                                          -----
                                                           504
```

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, c, d and e.

a) $\begin{array}{r} 86 \\ \underline{\times\ 10} \\ 0 \end{array}$ b) $\begin{array}{r} 86 \\ \underline{\times\ 10} \\ 00 \end{array}$ c) $\begin{array}{r} 86 \\ \underline{\times\ 10} \\ 00 \\ 6\ \end{array}$ d) $\begin{array}{r} 86 \\ \underline{\times\ 10} \\ 00 \\ 86\ \end{array}$ e) $\begin{array}{r} 86 \\ \underline{\times\ 10} \\ 00 \\ \underline{86\ } \\ 860 \end{array}$

4. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, c, d and e.

a) $\begin{array}{r} 79 \\ \underline{\times\ 10} \\ 0 \end{array}$ b) $\begin{array}{r} 79 \\ \underline{\times\ 10} \\ 00 \end{array}$ c) $\begin{array}{r} 79 \\ \underline{\times\ 10} \\ 00 \\ 9\ \end{array}$ d) $\begin{array}{r} 79 \\ \underline{\times\ 10} \\ 00 \\ 79\ \end{array}$ e) $\begin{array}{r} 79 \\ \underline{\times\ 10} \\ 00 \\ \underline{79\ } \\ 790 \end{array}$

5. Tell the students that the program they are about to use will teach them how to multiply a two-digit number by a two-digit multiplier without regrouping.

6. When the "Multiplication II" Disk is booted, a menu appears that lists four lessons. Students should select LESSON 4, OBJECTIVE 1. After completing it, students should complete LESSON 4, OBJECTIVE 3.

7. Before beginning an OBJECTIVE session, the student may choose to see how a problem is done. The student may also see the directions. If a student does an incorrect multiplication, the student is helped to achieve the correct answer.

Summary:

1. How do we multiply a two-digit number by a two-digit multiplier without regrouping?
2. How do we multiply two-digit numbers by 10?

Homework:

1. $\begin{array}{r} 42 \\ \underline{\times\ 12} \end{array}$ 2. $\begin{array}{r} 23 \\ \underline{\times\ 33} \end{array}$ 3. $\begin{array}{r} 14 \\ \underline{\times\ 12} \end{array}$ 4. $\begin{array}{r} 77 \\ \underline{\times\ 11} \end{array}$

5. $\begin{array}{r} 74 \\ \underline{\times\ 10} \end{array}$ 6. $\begin{array}{r} 62 \\ \underline{\times\ 10} \end{array}$ 7. $\begin{array}{r} 42 \\ \underline{\times\ 10} \end{array}$ 8. $\begin{array}{r} 91 \\ \underline{\times\ 10} \end{array}$

9. $\begin{array}{r} 40 \\ \underline{\times\ 21} \end{array}$ 10. $\begin{array}{r} 43 \\ \underline{\times\ 22} \end{array}$ 11. $\begin{array}{r} 32 \\ \underline{\times\ 32} \end{array}$ 12. $\begin{array}{r} 20 \\ \underline{\times\ 41} \end{array}$

13. $\begin{array}{r} 42 \\ \underline{\times\ 10} \end{array}$ 14. $\begin{array}{r} 69 \\ \underline{\times\ 10} \end{array}$ 15. $\begin{array}{r} 51 \\ \underline{\times\ 10} \end{array}$ 16. $\begin{array}{r} 65 \\ \underline{\times\ 10} \end{array}$

17. $\begin{array}{r} 32 \\ \underline{\times\ 31} \end{array}$ 18. $\begin{array}{r} 22 \\ \underline{\times\ 41} \end{array}$ 19. $\begin{array}{r} 79 \\ \underline{\times\ 11} \end{array}$ 20. $\begin{array}{r} 13 \\ \underline{\times\ 13} \end{array}$

Enrichment:

$\begin{array}{r} 22{,}101 \\ \underline{\times\quad 33} \end{array}$ $\begin{array}{r} 201{,}222 \\ \underline{\times\quad 24} \end{array}$ $\begin{array}{r} 230{,}332{,}220 \\ \underline{\times\quad 32} \end{array}$

TOPIC 25: Multiplying Numbers by a One-Digit Number

Aim: How do we multiply a number by a one-digit number with regrouping in one column only?

Performance Objectives: Students will be able to:

- multiply a two-digit number by a one-digit number with regrouping in one column only
- multiply a three-digit number by a one-digit number with regrouping in one column only
- multiply a four-digit number by a one-digit number with regrouping in one column only

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math-Multiplication II by The Continental Press Inc.

Motivation:

Jennifer's sister put 17 pennies in her bank every week for 5 weeks. How many pennies did she have in her bank?

Development:

1. Elicit from the students the answer to the motivation:

a)
$$\begin{array}{rcc} & \text{tens} & \text{ones} \\ & 3 & \\ & 1 & 7 \\ \times & & 5 \\ \hline & & 5 \end{array}$$

b)
$$\begin{array}{rcc} & \text{tens} & \text{ones} \\ & 3 & \\ & 1 & 7 \\ \times & & 5 \\ \hline & 8 & 5 \end{array}$$

a) Begin this example from the far right by multiplying the digit in the ones column by the multiplier 7 x 5 = 35. Place the 5 in the ones answer column and carry the 3 into the tens column.

b) Then multiply the digit in the tens column by the multiplier and add the carried digit 1 x 5 = 5 + 3 = 8

c) Therefore, 17 x 5 = 85

2. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a)  h                 b)  h               c)  h
    u                     u                   u
    n                     n                   n
    d                     d                   d
    r t o                 r t o               r t o
    e e n                 e e n               e e n
    d n e                 d n e               d n e
    s s s                 s s s               s s s

                          1                   1
    3 9 2                 3 9 2               3 9 2
  x     2               x     2             x     2
  -------               -------             -------
        4                   8 4               7 8 4
```

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a)  t              b)  t              c)  t              d)  t
    h h                h h                h h                h h
    o u                o u                o u                o u
    u n                u n                u n                u n
    s d                s d                s d                s d
    a r t o            a r t o            a r t o            a r t o
    n e e n            n e e n            n e e n            n e e n
    d d n e            d d n e            d d n e            d d n e
    s s s s            s s s s            s s s s            s s s s

                                          3                  3
    1 9 1 2            1 9 1 2            1 9 1 2            1 9 1 2
x         4        x         4        x         4        x         4
-----------        -----------        -----------        -----------
          8                4 8              6 4 8            7 6 4 8
```

4. Tell the students that the program they are about to use will teach them how to multiply a two-digit, three-digit, and four-digit number by a one-digit number with regrouping in one column only.

5. When the "Multiplication II" Disk is booted a menu appears that shows a choice of four lessons. Students should select LESSON 2, OBJECTIVE 3. After completing LESSON 2, OBJECTIVE 3, students should complete LESSON 3, OBJECTIVE 3.

6. Before beginning an OBJECTIVE session, the student may choose to see how a problem is done. The student may also see the directions. If a student does a problem incorrectly, the student is helped to achieve the correct answer.

Summary:

1. How do we multiply a two-digit number by a one-digit number with regrouping in one column only?
2. How do we multiply a three-digit number by a one-digit number with regrouping in one column only?
3. How do we multiply a four-digit number by a one-digit number with regrouping in one column only?

Homework:

1. 23 x 4
2. 25 x 3
3. 17 x 5
4. 72 x 4
5. 15 x 9
6. 40 x 9
7. 243 x 3
8. 209 x 4
9. 612 x 4
10. 112 x 8
11. 204 x 4
12. 920 x 3
13. 4207 x 2
14. 1292 x 3
15. 5114 x 2
16. 1702 x 4
17. 6224 x 2
18. 1121 x 9
19. 1041 x 6
20. 1080 x 8

Enrichment:

31,422 x 4

123,171 x 3

341,419,423 x 2

TOPIC 26: Multiplying Numbers With Regrouping in More Than One Column

Aim: How do we multiply numbers by a single-digit multiplier with regrouping in more than one column?

Performance Objectives: Student will be able to:

- multiply a number up to four digits by a one-digit number with regrouping in more than one column

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math - Multiplication II by The Continental Press Inc

Motivation:

Our grade has 7 classes of 36 students. How many students are in our grade?

Development:

1. Elicit from the students the answer to the motivation:

a) $$\begin{array}{r} 4 \\ 3\ 6 \\ \underline{\times\ \ \ 7} \\ 2 \end{array}$$

b) $$\begin{array}{r} 4 \\ 3\ 6 \\ \underline{\times\ \ \ 7} \\ 2\ 5\ 2 \end{array}$$

a) Begin this example from the far right by multiplying the digit in the ones column by the multiplier 6 x 7 = 42. Place the 2 in the ones answer column and carry the 4 into the tens column.
b) Then multiply the digit in the tens column by the multiplier and add the carried digit 3 x 7 = 21 + 4 = 25. Since there is no hundreds digit the 25 can be placed in the answer
c) Therefore, 36 x 7 = 252

2. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

a) $$\begin{array}{r} 5\ 9\ 4 \\ \underline{\times\ \ \ 8} \\ 2 \end{array}$$

b) $$\begin{array}{r} 3 \\ 5\ 9\ 4 \\ \underline{\times\ \ \ 8} \\ 5\ 2 \end{array}$$

c) $$\begin{array}{r} 7\ 3 \\ 5\ 9\ 4 \\ \underline{\times\ \ \ 8} \\ 4\ 7\ 5\ 2 \end{array}$$

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c

a) $$\begin{array}{r} 1862 \\ \underline{\times\ 4} \\ 8 \end{array}$$

b) $$\begin{array}{r} 2 \\ 1862 \\ \underline{\times\ 4} \\ 48 \end{array}$$

c) $$\begin{array}{r} 32 \\ 1862 \\ \underline{\times\ 4} \\ 448 \end{array}$$

d) $$\begin{array}{r} 32 \\ 1862 \\ \underline{\times\ 4} \\ 7448 \end{array}$$

4. Tell the students that the program they are about to use will teach them to multiply a two-digit, three-digit, and four-digit number by a one-digit number with regrouping in more than one column.

5. When the "Multiplication II" Disk is booted a menu appears that shows four choices of lessons. Students should select LESSON 1, OBJECTIVE 3. After completing LESSON 1, OBJECTIVE 3, students should complete LESSON 2, OBJECTIVE 4; and LESSON 3, OBJECTIVE 4, and OBJECTIVE 5.

6. Before beginning an OBJECTIVE session, the student may choose to see how a problem is done. The student may also see the directions. If a student does an incorrect multiplication, the student is helped to achieve the correct answer.

Summary:

1. How do we multiply a number by a one-digit number with regrouping in more than one column?

Homework: See attached worksheet:

Enrichment:

22,401 x 6

527,272 x 3

225,327,752 x 5

Homework Assignment:

1. 47 x 3
2. 83 x 6
3. 28 x 4
4. 77 x 2
5. 74 x 5
6. 62 x 8
7. 242 x 5
8. 914 x 5
9. 503 x 5
10. 573 x 6
11. 384 x 3
12. 277 x 3
13. 4062 x 5
14. 1769 x 9
15. 5118 x 8
16. 6590 x 4
17. 7332 x 7
18. 1222 x 9
19. 6565 x 6
20. 9999 x 9

TOPIC 27: Multiplying Two Two-Digit Numbers With Regrouping

Aim: How do we multiply two two-digit numbers with regrouping?

Performance Objectives: Student will be able to:

- multiply two-digit numbers by a two-digit multiplier with regrouping
- multiply two-digit numbers by multiples of 10

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math-Multiplication II by The Continental Press Inc.

Motivation:

A baseball stadium contains 23 sections. Each section can seat 42 people. How many people can the stadium seat?

Development:

1. Elicit from the students the answer to the motivation:

$$\text{a)}\ \begin{array}{r} 23 \\ \times\ 42 \\ \hline 6 \end{array} \qquad \text{b)}\ \begin{array}{r} 23 \\ \times\ 42 \\ \hline 46 \end{array} \qquad \text{c)}\ \begin{array}{r} 1 \\ 23 \\ \times\ 42 \\ \hline 46 \\ 2 \end{array} \qquad \text{d)}\ \begin{array}{r} 1 \\ 23 \\ \times\ 42 \\ \hline 46 \\ 92 \end{array} \qquad \text{d)}\ \begin{array}{r} 23 \\ \times\ 42 \\ \hline 46 \\ 92 \\ \hline 966 \end{array}$$

a) Begin this example from the far right by multiplying the digit in the ones column by the ones digit multiplier. 2 x 3 = 6

b) Then multiply the digit in the ones column by the ones digit of the multiplier. 2 x 2 = 4

c) Now multiply the digit in the ones column by the tens digit of the multiplier. 3 x 4 = 12. Line up the 2 under the second multiplier in the answer and carry the 1 as shown.

d) Then multiply the digit in the tens column by the tens digit of the multiplier and add the number that was carried. 4 x 2 + 1 = 9

e) Add the products as illustrated. Therefore 23 x 42 = 966

2. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, c, d and e.

$$\text{a)}\ \begin{array}{r} 72 \\ \times\ 62 \\ \hline 4 \end{array} \qquad \text{b)}\ \begin{array}{r} 72 \\ \times\ 62 \\ \hline 144 \end{array} \qquad \text{c)}\ \begin{array}{r} 1 \\ 72 \\ \times\ 62 \\ \hline 144 \\ 2 \end{array} \qquad \text{d)}\ \begin{array}{r} 1 \\ 72 \\ \times\ 62 \\ \hline 144 \\ 432 \end{array} \qquad \text{d)}\ \begin{array}{r} 72 \\ \times\ 62 \\ \hline 144 \\ 432 \\ \hline 4464 \end{array}$$

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, c, d and e.

a) 86	b) 86	c) 86	d) 86	d) 86
x 30	x 30	x 30	x 30	x 30
0	00	00	00	00
		8	258	258
				2580

4. Tell the students that the program they are about to use will teach them to multiply a two-digit number by a two-digit multiplier with regrouping.

5. When the "Multiplication II" is booted, a menu appears that lists four lessons. Students should select LESSON 4, OBJECTIVE 2. After completing, students should complete LESSON 4, OBJECTIVE 4. The student may now complete the TEST.

6. Before beginning an OBJECTIVE session, the student may choose to see how a problem is done. The student may also see the directions. If a student does an incorrect multiplication, the student is helped to achieve the correct answer.

Summary:

1. How do we multiply a two-digit number by a two-digit multiplier with regrouping?
2. How do we multiply two-digit numbers by multiples of 10?

Homework: See attached worksheet:

Enrichment:

45,672	304,175	344,727,300
x 27	x 70	x 94

Homework Assignment:

1. 63 x 54
2. 47 x 23
3. 28 x 53
4. 74 x 36
5. 26 x 20
6. 83 x 50
7. 66 x 80
8. 49 x 30
9. 44 x 33
10. 91 x 89
11. 28 x 46
12. 20 x 99
13. 33 x 40
14. 52 x 90
15. 76 x 50
16. 48 x 80
17. 39 x 39
18. 52 x 25
19. 78 x 42
20. 55 x 45

TOPIC 28: Multiplying Multiples of Ten, One Hundred, and One Thousand by a One-Digit Number

Aim: How do we multiply multiples of ten, one hundred, and one thousand by a digit number?

Performance Objectives: Student will be able to:

- multiply multiples of ten by a one-digit number
- multiply multiples of one hundred by a one-digit number
- multiply multiples of one thousand by a one-digit number

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Math-Multiplication II by The Continental Press Inc.

Motivation:

A storekeeper bought 3 boxes of looseleaf paper. Each box had 20 packs of paper in it. How many packs of paper did the store owner buy?

Development:

1. Elicit from the students that any number multiplied by zero is equal to zero.

2. Elicit from the students the answer to the motivation:

a) $\begin{array}{r} 20 \\ \times\ 3 \\ \hline 0 \end{array}$

b) $\begin{array}{r} 20 \\ \times\ 3 \\ \hline 60 \end{array}$

a) Begin this example from the far right by multiplying the digit in the ones column by the multiplier. 0 x 3 = 0

b) Then multiply the digit in the tens column by the multiplier. 2 x 3 = 6

c) Therefore, 20 x 3 = 60

3. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a) h              b)  h               c)  h
   u                  u                   u
   n                  n                   n
   d                  d                   d
   r t o              r t o               r t o
   e e n              e e n               e e n
   d n e              d n e               d n e
   s s s              s s s               s s s

   4 0 0              4 0 0               4 0 0
 x     2            x     2             x     2
 -------            -------             -------
       0                0 0               8 0 0
```

4. Do this practice example with the students. Go through the procedure as shown in steps 1a, b, and c.

```
a)  t          b)  t          c)  t          d)  t
    h h            h h            h h            h h
    o u            o u            o u            o u
    u n            u n            u n            u n
    s d            s d            s d            s d
    a r t o        a r t o        a r t o        a r t o
    n e e n        n e e n        n e e n        n e e n
    d d n e        d d n e        d d n e        d d n e
    s s s s        s s s s        s s s s        s s s s

    3 0 0 0        3 0 0 0        3 0 0 0        3 0 0 0
  x       3      x       3      x       3      x       3
  ---------      ---------      ---------      ---------
          0            0 0          0 0 0        9 0 0 0
```

Homework Assignment:

```
1.    20        2.    40        3.   10        4.   30
    x  3            x  2           x  5           x  8

5.    90        6.    40        7.  200        8.  800
    x  9            x  7           x  4           x  3

9.   600       10.   300       11.  900       12.  200
    x  4            x  9           x  5           x  9

13.  7000      14.  2000       15.  1000      16.  4000
    x   4           x   3           x   8          x   5

17.  9000      18.  3000       19.  5000      20.  8000
    x   8           x   6           x   6          x   8
```

PART V

Division of Whole Numbers

TOPIC 29: Dividing With No Remainders

Aim: How can we divide things equally?

Performance Objectives: Student will be able to:

- demonstrate that division is a process of equal sharing
- separate objects into various groupings
- determine the number of groupings of the separated objects

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- concrete objects: chips, squared materials, blocks (equal sizes for each concrete object)

Motivation: Write the following on the chalkboard:

> I have a baseball team that I coach. Yesterday I wanted to separate the 14 children into groups of 2 to practice throwing. How many groups did I wind up with?

Development:

1. To solve the problem, draw the 14 children and then erase two at a time and separate them at various locations on the chalkboard. Do various lessons using concrete objects or drawings to calculate the answers. Developmentally, this skill, in itself, will consume a number of lessons.

2. Introduce the standard mathematical symbols for division $3\overline{)6}$

3. Tell the students that the program they are about to use will teach them how to divide things into groups.

4. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

5. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

6. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

7. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self loading.

8. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students should enter MATH. When the screen prompts for a class number, the students input 1. And when the screen prompts for a password, the students will input MATH.

9. Ideally there should be one computer for each student. Most classes, however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before

the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #8), and work on one skill area only. The system will not retain records of the work.

10. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 2, 3, 5, 6, 7, 8, 10 through 18, 20 through 23, 25, 26, 28, 29, 31, 32, 34 through 39 (which corresponds to today's lesson). Check in the teacher's manual for the specific divisors used in each lesson.

11. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

12. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

13. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

14. No specific number of lessons are recommended for this skill. The process will cover quite a number of lessons. The software certainly gives the teacher an abundant tool to reinforce the division facts skills.

Summary:

1. If you had to share a certain number of things, how could division help you divide them up?

2. If we were at a party and I divided 12 pieces of candy among 6 children, how many pieces of candy would each child get?

3. If I had 18 pieces of candy, and I wanted to give 2 pieces to each child, how many children would get candy?

Homework:

Part One: If I have 12 candy bars, how many will each child get if there are:

1) 6 children __________	2) 4 children __________	3) 2 children __________
4) 3 children __________	5) 6 children __________	6) 8 children __________

Part Two: Find the quotients:

1. $4\overline{)\,16}$ 2. $5\overline{)\,25}$ 3. $7\overline{)\,42}$ 4. $2\overline{)\,8}$

5. $3\overline{)\,9}$ 6. $8\overline{)\,16}$ 7. $9\overline{)\,36}$ 8. $4\overline{)\,36}$

9. $2\overline{)\,4}$ 10. $8\overline{)\,24}$ 11. $7\overline{)\,21}$ 12. $3\overline{)\,15}$

13. $6\overline{)\,12}$ 14. $9\overline{)\,81}$ 15. $5\overline{)\,40}$ 16. $4\overline{)\,28}$

17. $3\overline{)\,27}$ 18. $7\overline{)\,49}$ 19. $7\overline{)\,63}$ 20. $2\overline{)\,20}$

Enrichment:

I have 4 children. I have 18 cents to give to them. What is my problem in division?

Write the problem mathematically.

What can I do to solve the problem and make things fair?

TOPIC 30: Dividing With Remainders

Aim: How can we divide when there is one or more remaining objects?

Performance Objectives: Students will be able to:

- demonstrate that division is a process of equal sharing
- separate objects into various groupings
- determine the number of groupings of the separated objects
- determine when equal sharing is not possible
- calculate the remaining items after sharing equally (limited to whole numbers)

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- concrete objects: chips, squared materials, blocks (equal sizes for each concrete object)

Motivation:

Write the following on the chalkboard:

I have a baseball team that I coach. Yesterday I wanted to separate the 17 children into groups of 2 to practice throwing.

What was my problem?

How many equally sized groups can I have? How many people will not be in a group?

Development:

1. To solve the problem, draw the 17 children and then erase two at a time and separate them at various locations on the chalkboard. Emphasize the problem of remainders. Review of previously taught estimation skills would prove very helpful at this point. Do various lessons using concrete objects or drawings to calculate the answers. Developmentally, this skill, in itself, will consume a number of lessons.

2. Tell the students that the program they are about to use will teach them how to divide things into groups that do not divide evenly.

3. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the subtraction series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students should input MATH. When the screen prompts for a class number, the students input 1. And when the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #8), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 40 or 41 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. Two to three sessions are recommended.

Summary:

1. In division, while sharing things, how must we divide the things up?
2. What causes a problem in dividing things up evenly?
3. If we were at a party and I divided 18 pieces of candy among 6 children, how many pieces of candy would each child get?
4. If I had 21 pieces of candy, and I wanted to give 3 pieces to each child, how many children would get candy?
5. If I had 34 pieces of candy, and I wanted to give 8 pieces to each child, how much would each child get? What would be left over?

Homework:

See attached homework sheet.

Enrichment:

1. If I have 5 children, and I give each child 4 pieces of candy, how many pieces did I start with?
2. If I have 5 children, and I give each child 4 pieces of candy, and I have three pieces left over, how many pieces did I start with?
3. Fill in the chart:

	# to start	# of children	# each receives	remainders
a)	28	7	4	0
b)	29	7	4	1
c)	13	4	3	?
d)	16	5	3	?
e)	35	4	?	3
f)	11	3	?	?
g)	61	?	8	?

Brainteaser:

h)	25	?	?	1

Homework Sheet: **Small Number Division With Remainders**

1) $\begin{array}{r} 2\ \ \text{R}\ 1 \\ 8\overline{)\,17} \end{array}$

2) $3\overline{)\,14}$

3) $3\overline{)\,11}$

4) $6\overline{)\,25}$

5) $5\overline{)\,17}$

6) $7\overline{)\,10}$

7) $2\overline{)\,13}$

8) $3\overline{)\,10}$

9) $8\overline{)\,19}$

10) $8\overline{)\,18}$

11) $4\overline{)\,19}$

12) $5\overline{)\,19}$

13) $2\overline{)\,11}$

14) $6\overline{)\,13}$

15) $9\overline{)\,11}$

16) $9\overline{)\,47}$

17) $6\overline{)\,16}$

18) $3\overline{)\,28}$

19) $4\overline{)\,27}$

20) $5\overline{)\,37}$

TOPIC 31: Dividing With a One-Digit Divisor

Aim: How do we divide using a one-digit divisor?

Performance Objectives: Students will be able to:

- identify a divisor
- identify a dividend
- recognize division as a form of repeated subtraction
- divide a one- to four-digit dividend by a one-digit divisor
- check quotient for accuracy

Materials:

- Apple computer lab
- software: Learning Division by Classroom Consortia Media, Inc.
- software: The New Arithmetic Classroom: Division by D.C. Heath

Vocabulary: divisor, dividend, quotient, remainder

Motivation:

Replace each question mark with the correct answer:
a) 4 x ? = 24
b) ? x 9 = 18
c) 6 x 5 = ?

Development:

1. Review the motivation. Elicit that the answer in a multiplication problem is called a product.
2. How many 4's are in 24? What operation might help us answer this question? (division)
3. How may this problem be rewritten as a division problem? (24 ÷ 4 = ?)
4. When this problem is written as a division problem, what is the answer called? (quotient)
5. Identify the divisor (4) and the dividend (24).
6. Rewrite the division in this form $4\overset{6}{\overline{)\,24}}$ Identify the divisor, dividend and quotient.
7. Rewrite questions b and c of the motivation in the same form.
8. How might we solve the following problem: 58/9 = ? ______ Rewrite this problem as $9\overline{)\,58}$
9. Elicit that the answer will not be a whole number but rather a whole number and a remainder. Review how a remainder may be written.
10. Review how the quotient may be checked for accuracy by multiplying the divisor by the dividend and adding the product to the remainder, if it exists.
11. Solve the following problem: $6\overline{)\,264}$

12. Review how a large number may be divided by a single-digit divisor, using short division.

13. To supplement this work, introduce the program LEARNING DIVISION by Classroom Consortia Media, Inc. When the program is booted, proceed to the DIVISION CONCEPT MENU of the program and select the concept to be practiced (selections A to D). This program, which contains both drill and practice, as well as diagnostic work, will serve as an additional reinforcement and practice of the material covered. Also, homework may be assigned from this program, for there is a section entitled HOMEWORK which will provide additional work on the material.

14. Another software program, entitled THE NEW ARITHMETIC CLASSROOM - DIVISION by D.C. Heath, may also be used to reinforce the work of the day. Division Lessons 1, 2, and 3 will provide practice with basic division facts as well as division with a single-digit divisor with and without regrouping. This program also provides additional "desk-work" which is included in the manual and may be duplicated for the students.

Applications:

1. Solve:

a. 3)12 b. 5)35 c. 8)56 d. 4)16

e. 9)81 f. 7)42 g. 2)14 h. 6)12

Summary:

How are division and subtraction related?
How are multiplication and division related?

Homework:

1. Solve each problem below. If the quotient contains a remainder, write the remainder in fractional form. (E.G. 28 5 = 5 3/5)

a. 2)15 b. 9)40 c. 6)34 d. 7)66

e. 22/5 f. 64/9 g. 28/3 h. 31/4

After each problem is solved, check the quotient for accuracy

2. Solve each problem below. If the quotient contains a remainder, express the remainder in fractional form.

a. 7)295 b. 3)438 c. 9)6844 d. 2)785

e. 293/7 f. 6851/5 g. 8690/4 h. 831/6

Enrichment:

Have students prepare averages of their grades in mathematics for the present marking period. Review what an average is and how it is determined.

TOPIC 32: Dividing With a One-Digit Divisor Using the Long Method

Aim: How can we divide with a one-digit divisor?

Performance Objectives: Students will be able to:

- identify a divisor, dividend and quotient
- divide a one to four-digit dividend by a one-digit divisor using the "long division algorithm"
- write the remainder in fractional form
- identify relevant and irrelevant data within a division word problem

Materials:

- Apple computer lab
- software: Learning Division by Classroom Consortia Media, Inc.
- software: The New Arithmetic Classroom: Division by D.C. Heath

Vocabulary: divisor, dividend, quotient, remainder, algorithm

Motivation:

Using the "short division" method we learned yesterday, solve the following problems:

a) 656/8   b) $5\overline{)\,2849}$ c) 1834/7

Development:

1. Discuss the use of the short division method to solve problem a. Recall that the problem may be rewritten in the form $8\overline{)659}$. Have the class solve the problem using short division.

2. How may we check to be sure our answer is correct? Review how to check a division problem.

3. Have the class then review problems b and c. Discuss how the remainder may be written in a division problem.

4. Is there another way of doing a division problem? Is there a way of doing the problem and writing down all that is done as the problem is done?

5. Elicit from the class the steps it takes to solve a division problem. What is done first? (divide) How do we know the answer is correct? (multiply) What happens after we multiply? (subtract) Once we subtract, what do we do next? (bring down the next digit)

6. Once the steps have been elicited, review them on the blackboard, showing that what has now been presented is a step-by-step method of solving any division problem. This is called an "algorithm." It is often helpful to compare an algorithm with following the steps in a recipe to create some item of food.

7. Now, review each problem again, this time using the algorithm and writing the problem in "long division" form.

8. How would we solve the following problem?
   Mr. Jones drove 179 miles and used 8 gallons of gasoline during the 4-hour drive. What was the average amount of miles per gallon of gasoline?

9. Have the class rewrite the problem in arithmetic form as a division problem. Discuss the fact that all data need not be relevant to a specific problem. Discuss how to decide if data is important to solve a particular problem.

10. Have the class solve the problem and check their answer for accuracy. Stress the importance of labeling the answer as miles and discuss how all answers should be labeled to identify the answer not just as a number, but rather, a quantity of something.

11. Now, add the following question to the problem:
What was Mr. Jones' average speed per hour?
Have the class solve the problem, labelling the answer correctly.

12. To reinforce this work, introduce the program LEARNING DIVISION by Classroom Consortia Media, Inc. When the program is booted, proceed to the DIVISION CONCEPT MENU of the program and select the concept to be practiced (selections B to D). This program, which contains both drill and practice, as well as diagnostic work, will serve as an additional reinforcement and practice of the material covered. Also, homework may be assigned from this program for there is a section entitled HOMEWORK which will provide additional work on the material.

13. Another software program, entitled THE NEW ARITHMETIC CLASSROOM - DIVISION by D.C. Heath Publishing Company, may also be used to reinforce the work of the day. Division lesson 3 will provide practice with basic division facts as well as division with a single digit divisor with regrouping. This program also provides additional "desk-work" which is included in the manual and may be duplicated for the students.

Applications:

1. Solve each problem below. Verify that each answer is correct, using the check method.

   a. $7\overline{)462}$ b. $5\overline{)698}$ c. $8\overline{)91}$ d. $4\overline{)732}$

   e. $9\overline{)891}$ f. $7\overline{)834}$ g. $2\overline{)6452}$ h. $6\overline{)2758}$

Summary:

What is the division algorithm? What steps are needed to solve a long division problem?

Homework:

1. Read each problem below. Decide what information is relevant to the problem, and what information is not relevant to the problem. Make two columns and label one RELEVANT INFORMATION and the other IRRELEVANT INFORMATION. Then, place the information from each problem in the correct column.
   a) If 225 boys and 169 girls are in the seventh grade, how many groups of 5 boys each can be made?

   b) Maryanne had 279 baseball cards which she collected in 13 days. If she divided these cards evenly among 9 friends, how many cards did each friend receive?

c) Mark ran 100 miles in 9 days. Last month he ran one day. How many miles per day did he average?

d) Barbara earned $846 during 1986. If she worked only 6 months, what was her average salary per month?

e) A train travelled 894 miles in 3 hours. There were 205 passengers travelling on the train. What was the average speed per hour?

Enrichment:

Have the students create their own word problems, including relevant and irrelevant data within the problem. Once they are created, compile the problems and distribute the set to the class. Have them discuss the problems, identifying data that is relevant and irrelevant. Then, have them solve each problem.

TOPIC 33: Dividing With a Two-Digit Divisor Using the Long Method

Aim: How can we divide using a two-digit divisor?

Performance Objectives: Students will be able to:

- identify a divisor, dividend and quotient
- divide a one- to four-digit dividend by a two-digit divisor using the "long division algorithm"
- write the remainder in fractional form
- use the zero as a place holder within the quotient

Materials:

- Apple computer lab
- software: Learning Division by Classroom Consortia Media, Inc.
- software: The New Arithmetic Classroom - Division by D.C. Heath

Vocabulary:

divisor, dividend, quotient, remainder, algorithm

Motivation:

Solve the following problems.

a) Kevin went to the store and purchased four baseball gloves. If the total cost was $136, what was the average price per baseball glove?

b) Michele earned $188. If she worked 14 days, how much did she earn per day?

Development:

1. Review motivation a. Tell the class that the problem may be rewritten in the form $4\overline{)136}$.
   Have the class solve the problem using long division.

2. How may we check to be sure our answer is correct? Review how to check a division problem.

3. Have the class then review problem b. How may this division be written in arithmetic form? $14\overline{)188}$ Review the long division procedures needed to complete this problem. Then, solve the problem.

4. Discuss how division, using a two-digit divisor, may be completed.

5. Place the following problem on the blackboard and ask the class to only do the first round of the algorithm.

$$32\overline{)3348}$$

6. At this point, the problem should appear on the board as follows:

$$\begin{array}{r@{}l} & 1 \\ 32 & \overline{)3348} \\ & \underline{-32} \\ & 14 \end{array}$$

7. Now, ask the children what the next step should be in solving this problem? (divide) How may we divide 14 by 32? (we cannot because 32 is larger than 14.) What must we do?

8. At this point, it should be discussed that when the divisor cannot go into the existing dividend, a zero must be inserted in the quotient at that point, so that the place value is held for the digits. Stress that even though a number cannot be divided within the division problem, that fact must be accounted for within the existing problem by using the zero to hold the place value.

9. Complete the rest of the problem with the class, discussing how the remainder may be written in fractional form and how the final quotient may be checked for accuracy.

10. To reinforce this work, introduce the program, LEARNING DIVISION by Classroom Consortia Media, Inc. When the program is booted, proceed to the DIVISION CONCEPT MENU of the program and select the concept to be practiced (selections H to L). This program, which contains both drill and practice, as well as diagnostic work, will serve as an additional reinforcement and practice of the material covered. Also, homework may be assigned from this program, for there is a section entitled HOMEWORK which will provide additional work on the material.

11. Another software program, entitled THE NEW ARITHMETIC CLASSROOM - DIVISION by D.C. Heath, may also be used to reinforce the work of the day. Division Lessons 4 and 5 will provide practice with two-digit divisors with regrouping and without regrouping. This program also provides additional "desk-work" which is included in the manual and may be duplicated for the students.

Summary:

How is the place value held in a division problem when a dividend cannot be divided by the divisor?

Homework:

1. Solve each problem below. Verify that each answer is correct, using the check method.

a. $27\overline{)462}$ b. $35\overline{)698}$ c. $81\overline{)91}$ d. $24\overline{)732}$

e. $19\overline{)8951}$ f. $73\overline{)8346}$ g. $42\overline{)6452}$ h. $60\overline{)2758}$

i. $12\overline{)2456}$ j. $92\overline{)8945}$ k. $56\overline{)22456}$ l. $33\overline{)13860}$

m. $40\overline{)160}$ n. $20\overline{)1780}$ o. $80\overline{)1240}$ p. $50\overline{)10400}$

Enrichment:

Have the class choose a place they would like to visit that is far away. Determine the mileage to get there. Then, have the class determine
a) How long it will take if you travel 65 mph
b) How many hours it will take if you travel 40 mph
c) How fast you will travel if you travel 6 days, and 5 hours per day.

TOPIC 34: Dividing Two-Digit Numbers With Remainders

Aim: How can we divide two-digit numbers?

Performance Objectives: Students will be able to:

- demonstrate that division is a process of equal sharing
- separate objects into various groupings
- determine the number of groupings of the separated objects
- determine when equal sharing is not possible
- calculate the remaining items after sharing equally (limited to whole numbers)
- calculate remainders in division problems

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- concrete objects: chips, squared materials, blocks (equal sizes for each concrete object)

Vocabulary: quotient, divisor, dividend

Motivation: Write the following on the chalkboard:

> I have three children and 37 pieces of candy. I need help in calculating. How many pieces does each child get? Please set up the math problem in your notebook and solve it for me.
> Is anyone experiencing any problems?
> What problems do you see in solving it?

Development:

1. An introductory review of place value is important. Division is performed from left to right, unlike other operations in which you start in the ones column and work to the right. Each step of the division sequence should be thoroughly reviewed. In addition, review the previously taught skill of finding remainders.

2. Tell the students that the program they are about to use will teach them how to divide things into groups that do not divide evenly.

3. Prior to bringing the class into the computer lab, the teacher must enter certain information on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A, ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B, RETURN TO TITLE PAGE. This must be done for each disk in the division series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the

screen prompts for a class number, the students input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally there should be one computer for each student. Most classes however require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A, ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 42 to 44 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. Two to three sessions are recommended.

Summary:

1. When we share things, how can we use division to determine how to divide things up?
2. What causes a problem in dividing things up evenly?
3. If we were at a party and I divided 18 pieces of candy among 6 children, how many pieces of candy would each child get?
4. If I had 21 pieces of candy, and I wanted to give 3 pieces to each child, how many children would get candy?
5. If I had 36 pieces of candy, and I wanted to give 3 pieces to each child, how many children would get candy?
6. If I had 34 pieces of candy, and I wanted to give 8 pieces to each child, how many children would get candy? What would be left over?
7. If I had 97 pieces of candy, and I wanted to give 8 pieces to each child, how many children would get candy? What would be left over?

Homework:

1. $\begin{array}{r} 12 \\ 4\overline{)48} \end{array}$ 2. $\begin{array}{r} 13 \\ 6\overline{)78} \end{array}$ 3. $\begin{array}{r} 11\ \text{R3} \\ 5\overline{)58}\phantom{\ \text{R3}} \end{array}$ 4. $3\overline{)47}$ 5. $2\overline{)38}$

6. $9\overline{)99}$ 7. $5\overline{)79}$ 8. $3\overline{)46}$ 9. $2\overline{)29}$ 10. $2\overline{)83}$

11. $4\overline{)85}$ 12. $5\overline{)69}$ 13. $4\overline{)69}$ 14. $5\overline{)59}$ 15. $6\overline{)60}$

16. $6\overline{)96}$ 17. $4\overline{)81}$ 18. $6\overline{)58}$ 19. $2\overline{)85}$ 20. $4\overline{)97}$

21. $7\overline{)93}$ 22. $7\overline{)87}$ 23. $8\overline{)90}$ 24. $3\overline{)90}$ 25. $4\overline{)52}$

Enrichment:

1. If I have 5 children, and I give each child 15 pieces of candy, how many pieces did I start with?
2. If I have 3 children, and I give each child 14 pieces of candy and I have three pieces left over, how many pieces did I start with?
3. Fill in the chart:

	# to start	# of children	# each receives	remainders
a)	98	7	14	0
b)	99	7	4	1
c)	53	4	13	?
d)	66	5	13	?
e)	43	4	?	3
f)	51	3	?	?
g)	91	?	8	?

Brainteaser:

h)	75	?	?	1

TOPIC 35: Using Multiplication Facts to Solve Division Problems

Aim: How can we use multiplication facts to help solve division facts?

Performance Objectives: Students will be able to:

- recognize the connection betweem multiplication and division
- solve division problems
- draw upon previous knowledge of multiplication facts to solve problems involving division facts

Materials:

- Apple computer lab (color monitors)
- software: Revised Math Sequences by Milliken Publishing Co.

Motivation:

Write the following on the chalkboard:

$2 + 5 = 7$ $\qquad$ $2 + 5 = 10$

$7 - 5 = 2$ $\qquad$ $10/5 = 2$ (slash means divide)

If an unknown division problem was presented - $6/3 = ?$, how would knowing the answer to $3 \times \_ = 6$ help to solve the problem?
First, we have to improve our missing factors skills.

Development:

1. After the motivation, present a series of problems on the chalkboard.

2. Tell the students that the program they are about to use will teach them how to calculate missing factors in multiplication, which will help them in division facts.

3. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold the "Control " key down and press the "I" key.

4. Select option A - ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts "CLASS NAME?";
again select MATH. Then the screen prompts "PASSWORD?"; again select MATH (the screen displays xxxxxx).

5. Finally select Option B - RETURN TO TITLE PAGE. This must be done for each disk in the division series.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the TITLE PAGE appears, tell the students to press the RETURN key. The screen prompts for a name: the students will input MATH. When the screen prompts for class number, the students should input 1. And when the screen prompts for a password, the students will input MATH.

8. Ideally, each student has a computer. Most classes, however, require 2 to 3 students per computer. Since this software is also a management

system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review # 7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts correspond to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem (2x_ = 8). The student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen gives the student the correct answer. The program then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty if the students demonstrate mastery at the current level. If not the students remain at the same level until they either demonstrate mastery or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20 minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the "ESC" key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One or two sessions per skill is adequate. The second session can be used less as a group lesson. The teacher can now use different levels for each group (as per their ability), to review the current skill.

Summary:

1. If 6 x 5 = 30, then what does 30/5 = ?
2. What is the quotient of 40/8?
3. If a, b, and c are all different numbers, and a x b = c, then c/b =?

Homework:

- The homework for this lesson can be generated by the management system itself. Insert the Worksheet Generator disk into a computer, which is connected to a printer. The disk is self-loading. The teacher must select the skill area (i. e. division), the level # (#1 which corresponds to today's lesson), and the number of problems desired. The computer will then generate a formatted homework sheet based on the previous information.

Enrichment:

1. If 2 x 4 = 8, and 4 x 2 = 8, and 8/4 = 2, and 8/2 = 4, please create as many number sentence families as possible using:
   a) 3, 4, 12
   b) 2, 5, 10
   c) 5, 8, 40
   d) 4, 7, 28
   e) 8, 9, 72

Division Sequence 1

Name______________________ Date ________________

1. 2 x __ = 6
2. 1 x __ = 1
3. 2 x __ = 16
4. 1 x __ = 6
5. 2 x __ = 2
6. 1 x __ = 2
7. 2 x __ = 12
8. 1 x __ = 0
9. 2 x __ = 2
10. 1 x __ = 7
11. 2 x __ = 18
12. 2 x __ = 12
13. 1 x __ = 9
14. 2 x __ = 14
15. 1 x __ = 6
16. 1 x __ = 1
17. 1 x __ = 8
18. 1 x 2 __ 2
19. 2 x __ = 18
20. 1 x __ = 0
21. 2 x __ = 8
22. 2 x __ = 2
23. 1 x __ = 7
24. 1 x __ = 3
25. 1 x __ = 6

Division Sequence 1

Answers

Name ______________________ Date ____________________

1. 2 x 3 = 6
2. 1 x 1 = 1
3. 2 x 8 = 16
4. 1 x 6 = 6
5. 2 x 1 = 2
6. 1 x 2 = 2
7. 2 x 6 = 12
8. 1 x 0 = 0
9. 2 x 1 = 2
10. 1 x 7 = 7
11. 2 x 9 = 18
12. 2 x 6 = 12 13.
13. 1 x 9 = 9
14. 2 x 7 = 14
15. 1 x 6 = 6
16. 1 x 1 = 1
17. 1 x 8 = 8
18. 1 x 2 = 2
19. 2 x 9 = 18
20. 1 x 0 = 0
21. 2 x 4 = 8
22. 2 x 1 = 2
23. 1 x 7 = 7
24. 1 x 3 = 3
25. 1 x 6 = 6

PART VI

Fractions

TOPIC 36: Drawing a Picture to Represent a Fraction

Aim: How do we draw a picture that represents a fraction?

Performance Objectives: Students will be able to:

- create a picture that represents the denominator of a fraction
- shade in the portion of the picture that represents the numerator of the fraction

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Basic Fractions Skills Disk

Motivation:

Jack's mother bakes an apple pie. She cuts it into eight pieces. If four pieces remain after lunch, what fraction is represented by the pie? Draw a picture of the pie, shading in the pieces left.

Development:

1. Place the circle on the board. Have a student divide it into eight pieces. Have another student color the part of the circle that represents $\frac{4}{8}$.

2. Elicit from the students the denominator of the fraction which represents the total number of parts of pieces.

3. Elicit from the students that the number of pieces to be shaded represents pieces left. It is equal to the numerator of the fraction.

4. Tell the students that the program they are about to use will teach them how to draw a picture that represents a fraction.

5. When the "Basic Fractions Skills" disk is booted, a menu appears. Students should select LESSON, SKILL 2 and EXERCISE 1, 2 or 3. There are 36 examples. The student can then proceed to SKILL 4 and EXERCISE 1, 2 or 3. There are another 36 examples.

6. If a student misses 2 examples in a row, an automatic help lesson is performed.

7. Students who have finished SKILLS 1-4 can then work on Review 1.

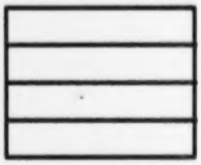
Summary:

1. Which part of the picture represents the denominator of the fraction?
2. Which part of the picture represents the numerator of the fraction?
3. How can we draw a picture to represent a fraction?

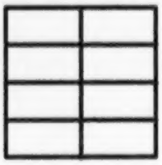
Homework:

Shade in each picture to represent the fraction indicated

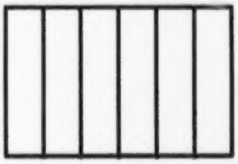
$\frac{3}{4}$ =



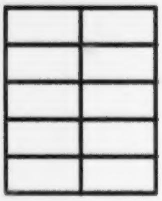
$\frac{5}{8}$ =



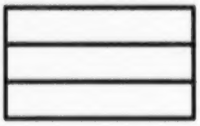
$\frac{5}{6}$ =



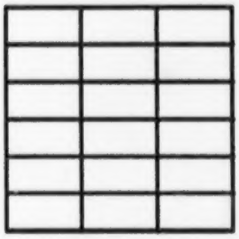
$\frac{9}{10}$ =



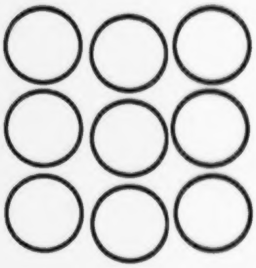
$\frac{3}{3}$ =



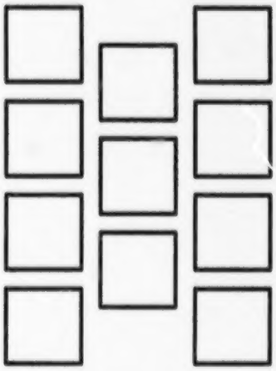
$\frac{15}{18}$ =



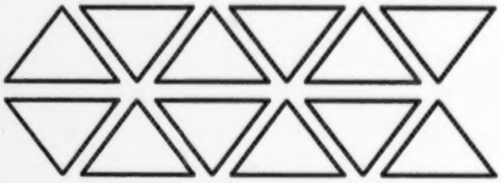
$\frac{7}{9}$ =



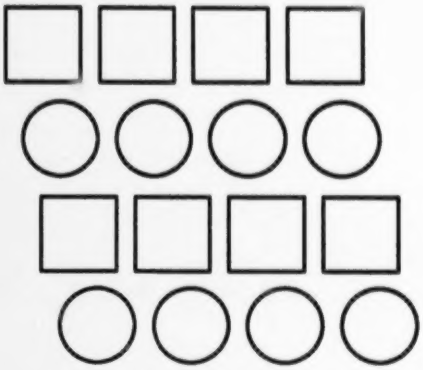
$\frac{6}{11}$ =



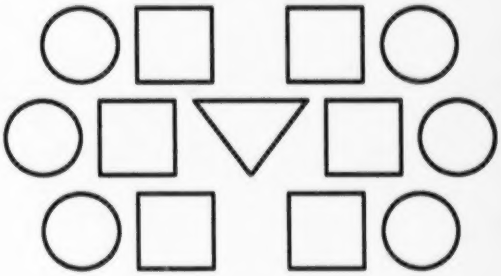
$\frac{9}{12}$ =



$\frac{15}{16}$ =



$\frac{6}{13}$ =



Enrichment:

Draw a picture that represents the fraction: $\frac{15}{8}$

TOPIC 37: Representing a Picture as a Fraction

Aim: How do we write a fraction based on a picture?

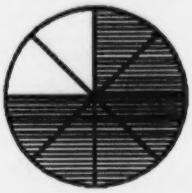
Performance Objectives: Students will be able to:

- look at a picture and recognize the denominator of a fraction
- look at a picture and recognize the numerator of a fraction
- use the above information to write a fraction

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Basic Fractions Skills Disk

Motivation:



A pizza is cut into 8 slices. After lunch there are 6 slices left. What part of the whole pizza is left?

Development:

1. Place the picture of the pizza on the board. Elicit from students the total number of slices in the original pizza. Elicit from students that the number that represents the whole or total amount is the denominator of the fraction.

2. Elicit from the students the number of slices of pizza that still remain after lunch. Elicit from the students that this number, the part of the whole, represents the numerator of the fraction.

3. Challenge the students to represent the shaded area as a fraction. The students should see that 6/8 of the pizza remained after lunch was finished.

4. Tell the students that the program they are about to use will teach them to write fractions from similar pictures.

5. When the "BASIC FRACTIONS SKILLS" Disk is booted, a menu appears. Students should select LESSON, SKILL 1 and EXERCISE 1, 2 or 3. There are 36 examples. The student can then proceed to SKILL 3 and EXERCISE 1, 2 or 3. There are another 36 examples.

6. If a student misses 2 examples in a row, an automatic help lesson is performed.

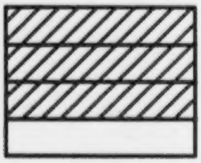
Summary:

1. Which part of the picture represents the denominator of the fraction?
2. Which part of the picture represents the numerator of the fraction?
3. How do we represent the fraction?

Homework:

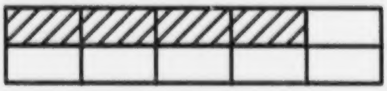
Write a fraction that represents the shaded portion of each picture

1.



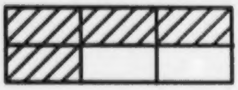
= ___

2.



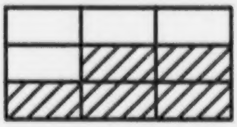
= ___

3.



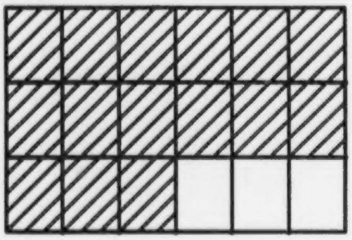
= ___

4.



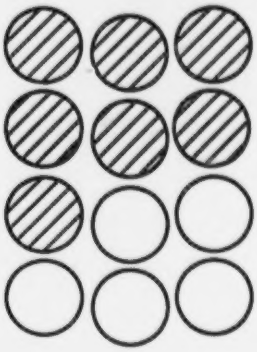
= ___

5.



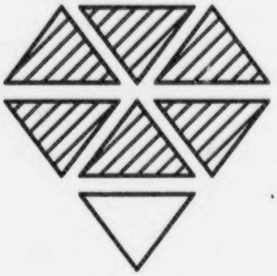
= ___

6.



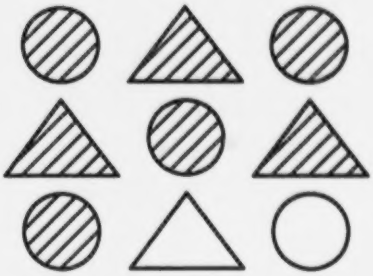
= ___

7.



= ___

8.



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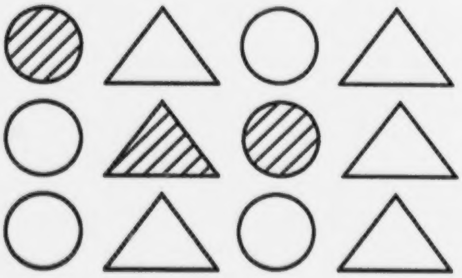
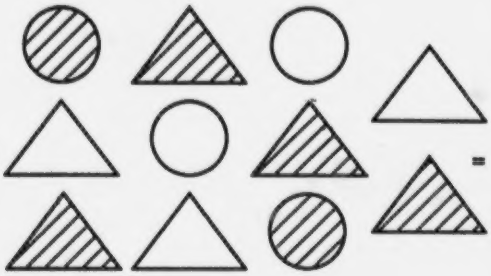
9.



= ___

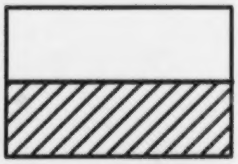
10.



= ___

Enrichment:

How can we change this picture to represent fourths instead of halves? How many fourths are there?



TOPIC 38: Listing the Factors of a Number

Aim: How do we find the factors of a number?

Performance Objectives: Students will be able to:

- define factor
- identify a factor of a number given one factor
- list all factors of a number

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Basic Fractions Skills Disk

Motivation:

What numbers can 6 be divided by evenly?

Development:

1. Elicit from students a number that divides into 6 evenly. This number is called a factor of 6. A number that divides another number evenly is called a factor of that number. In 2x3=6, 2 is a factor of 6 and 3 is a factor of 6.
2. Elicit from students all factor pairs of the number six. (1 x 6, 2 x 3).
3. Is 2 a factor of 6? Why? 2 divides 6 evenly or 2x3=6. Is 4 a factor of 6? Why? 4 does not divide 6 evenly or 6 is not divisible by 4.
4. Elicit a list of the factors of 6 in order from smallest to largest. (1, 2, 3, 6)
5. Elicit from students the factor pairs of the number 12. (1 x 12, 2 x 6, 3 x 4)
6. Is 2 a factor of 12? Why? 2 divides 12 evenly or 2 x 6 = 12. Is 5 a factor of 12? Why? 5 does not divide 12 evenly or 12 is not divisible by 5.
7. Display a list of the factors of 12 in order from smallest to largest. (1, 2, 3, 4, 6, 12)
8. Ask students to list the factors of 9. (1, 3, 9) 3 x 3 is a factor pair but 3 is only written once in listing the factors.
9. Elicit from the students, factors which are always factors of every number. (1 and the number itself)
10. Remind students to try numbers in numerical order. When factor pairs repeat, they have found all factors of a number. For example: the factor pairs of the number 12 are 1 x 12, 2 x 6, 3 x 4, 4 x 3, 6 x 2, 12 x 1. Notice that 3 x 4 and 4 x 3 are the same factor pair. We can stop looking for more pairs.
11. Tell the students that the program they are about to use will teach them how to find the factors of a number.

12. When the "Basic Fractions Skills" disk is booted, a menu appears. Students should select LESSON, SKILL 5, and EXERCISE 1. After completing EXERCISE 1 students should complete EXERCISE 2 and EXERCISE 3 in Skill 5.

13. If a student misses two lessons in a row, an automatic help lesson is performed.

Summary:

1. What is a factor of a number?
2. How do we list the factor pairs of a number?.
3. How do we list the factors of a number?.

Homework: See attached worksheet

Enrichment:

What is the largest 2-digit number that has 6 as a factor?
What is the largesr 3-digit number that has 6 as a factor?

HOMEWORK ASSIGNMENT

Fill in the missing factor:

product	one factor	other factor
15	5	
36	12	
40	8	
21	7	
52	2	
144	16	

List all factor pairs for these products: List of Factors

product:	factor pairs
9	
17	
22	
20	
24	
48	

List all factors of:

product	list of factors
15	
18	
7	
30	
36	
144	

TOPIC 39: Finding the Greatest Common Factor (GCF) of Two Numbers

Aim: How do we find the Greatest Common Factor (GCF) of two numbers?

Performance Objectives: Students will be able to:

- list all factors of two numbers
- list all common factors of two numbers
- recognize the greatest common factor of two numbers

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

Why does 144 have an odd number of factors?
What are the factors of 144?

Development:

1. Elicit from students the procedure for finding the GCF of two numbers:
   a) list all of the factors of the two numbers
   b) list all of the common factors of the two numbers
   c) choose the largest common factor which we call the GCF of two numbers

2. Guide the students through these examples. Ask the students to find the GCF of:
   a) 12 and 24
      Elicit from students the factors of 12: (1,2,3,4,6,12)
      Elicit from students the factors of 24: (1,2,3,4,6,12,24)
      Elicit from students the common factors of 12 and 24: (1,2,3,4,6,12)
      Elicit from students that the GCF of 12 and 24 is 12
   b) 50 and 75
      Elicit from students the factors of 50: (1, 2, 5, 10, 25, 50)
      Elicit from students the factors of 75: (1, 3, 5, 15, 25, 75)
      Elicit from students the common factors of 50 and 75: (1, 5, 25)
      Elicit from students that the GCF of 50 and 75 is 25
   c) 32 and 144 (Use motivation answer)
      Elicit from students the factors of 32: (1,2,4,8,16,32)
      The factors of 144: (1,2,3,4,6,8,9,12,16,18,36,48,72,144)
      Elicit from students the common factors of 32 and 144: (1,2,4,8,16)
      Elicit from students that the GCF of 32 and 144 is 16

3. Students should realize that if the larger number is divisible by the smaller number, the smaller number is the GCF of the two numbers. (See example 2a above.)
   Example: The GCF of 4 and 12 is 4 because 12 is divisible by 4
   The GCF of 14 and 7 is 7 because 14 is divisible by 7
   The GCF of 36 and 18 is 18 because 36 is divisible by 18

4. Tell the students that the program they are about to use will teach them to find GCF of two numbers.

5. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON, SKILL 6 and EXERCISE 2 and EXERCISE 3.

6. If a student misses 2 examples in a row, the program provides an automatic help lesson.

Summary

1. How do we list the factors of a number?
2. What is a common factor of two numbers?
3. What is the greatest common factor (GCF) of two number?

Homework: See attached worksheet

Enrichment:

Find the GCF of 72, 48, and 96.

Homework Assignment

Find the greatest common factor (GCF) after listing the factors of these numbers:

1.

6: ____________________

10: ____________________

GCF= ________

2.

8: ____________________

16: ____________________

GCF= ________

3.

12: ____________________

16: ____________________

GCF= ________

4.

15: ____________________

16: ____________________

GCF= ________

5.

30: ____________________

45: ____________________

GCF= ________

6.

12: ____________________

18: ____________________

GCF= ________

7.

18: ____________________

27: ____________________

GCF= ________

8.

36: ____________________

48: ____________________

GCF= ________

9.

24: ____________________

36: ____________________

48: ____________________

GCF= ________

10.

72: ____________________

96: ____________________

144: ____________________

GCF= ________

TOPIC 40: Finding the Greatest Common Factor (GCF) From a List of Factors

Aim: How do we find the Greatest Common Factor (GCF) of two numbers from a list of factors of those numbers?

Performance Objectives: Students will be able to:

- view a list of all factors of two numbers
- list all common factors of two numbers
- recognize the Greatest Common Factor of two numbers

Material:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

What numbers can be divided into 12?

Development:

1. Display on the chalkboard the list of factors of 9 and the list of factors of 12 (use Motivation)
   The list of factors of 9 is (1,3,9)
   The list of factors of 12 is (1,2,3,4,6,12)

2. Elicit from students which factors are the same for both numbers? (1,3)
   The factors 1 and 3 are called the common factors of 9 and 12.
   Common factors are those factors which are factors of both numbers.

3. Which of the common factors of 9 and 12 is the largest? (3)
   3 is called the greatest common factor (GCF)
   The greatest common factor (GCF) of a number is the largest number that is a factor of both numbers.

4. Find the GCF of 8 and 12.
   Display a list of the factors of 8 and 12.
   The list of factors of 8 is (1,2,4,8)
   The list of factors of 12 is (1,2,3,4,6,12)
   Elicit from students the common factors of 8 and 12 (1,2,4)
   Which factor is the GCF? (4)

5. Using the same procedure described in step 4 above, guide students through these two examples:
   a) Find the GCF of 12 and 18
      Display the list of factors of 12: (1,2,3,4,6,12)
      Display the list of factors of 18: (1,2,3,6,9,18)
      Elicit from students that the common factors of 12 and 18 are (1,2,3,6)
      Elicit from students that the GCF of 12 and 18 is 6

   b) Find the GCF of 15 and 16
      Display the list of factors of 15: (1,3,5,15)
      Display the list of factors of 16: (1,2,4,8,16)
      Elicit from students that there is only one common factor of 15 and 16 (1)
      Elicit from students that the GCF of 15 and 16 is 1

When the GCF of two numbers is 1, the numbers are called relatively prime.

6. Tell the students that the program they are about to use will teach them to find the GCF of two numbers by examining the given factors of those numbers.

7. When the "Fractions Basic" Disk is booted, a menu appears. Students should select LESSON, SKILL 6 and EXERCISE 1.

8. If a student misses 2 examples in a row, an automatic help lesson is provided

Summary:

1. How do we list the factors of a number?
2. What are the common factors of two numbers?
3. What is the Greatest Common Factor (GCF) of two numbers?
4. When are two numbers relatively prime?

Homework: See attached worksheet

Enrichment:

Name two numbers whose GCF is 15.
Name two numbers whose GCF is 11.
Name two numbers whose GCF is 1.
Name two numbers whose GCF is 12.

Homework Assignment

Find the Greatest Common Factor (GCF) of these pairs of numbers. List the Common Factors after examining the list of factors of the numbers.

1.

8: 1,2,4,8

10: 1,2,5,10

Common Factors:________________

GCF=_________

2.

8: 1,2,4,8

12: 1,2,3,4,6,12

Common Factors:________________

GCF=_________

3.

15: 1,3,5,15

18: 1,2,3,6,9,18

Common Factors:________________

GCF=___________

4.

16: 1,2,4,8,16

25: 1,5,25

Common Factors:________________

GCF=___________

5.

25: 1,5,25

35: 1,5,7,35

Common Factors:________________

GCF=___________

6.

21: 1,3,7,21

28: 1,2,4,7,14,28

Common Factors:_______________

GCF=__________

7.

15: 1,3,5,15

45: 1,3,5,9,15,45

Common Factors:______________

GCF=__________

8.

12: 1,2,3,4,6,12

18: 1,2,3,6,9,18

Common Factors:_______________

GCF=__________

9.

24: 1,2,3,4,6,8,12,24

36: 1,2,3,4,6,9,12,18,36

Common Factors:_______________

GCF=__________

10.

32: 1,2,4,8,16,32

48: 1,2,3,4,6,8,12,16,24,48

Common Factors:_______________

GCF=__________

TOPIC 41: Finding the Multiples of a Number

Aim: How do we find the multiples of a number?

Performance Objectives: Students will be able to:

- define the term multiple
- find the first four non-zero multiples of a number
- find all multiples of a number

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

- Write the 6 times table for all products less than 100.

Development:

1. Elicit from students the "2" multiplication table
   2 x 0 = 0   2 x 1 = 2   2 x 2 = 4   2 x 3 = 6
   Ask another student to count by 3.
   3, 6, 9, 12, 15, etc.

2. Display the answer to the motivation:
   6 x 0 = 0, 6 x 1 = 6, 6 x 2 = 12, 6 x 3 = 18, 6 x 4 = 24, 6 x 5 = 30.

   6 x 6 = 36, 6 x 7 = 42, 6 x 8 = 48, 6 x 9 = 54, 6 x 10 = 60,

   6 x 11 = 66, 6 x 12 = 72, 6 x 13 = 78, 6 x 14 = 84, 6 x 15 = 90,

   6 x 16 = 96

3. In each case, the students have been reciting the multiples of 2, the multiples of 3 and the multiples of 6.
   Definition: A multiple of a number is the product of that number multiplied by a whole number. (NOTE: Since zero is a whole number and 5 x 0 = 0, then 0 is a multiple of 5. In fact, 0 is the smallest multiple of every number. In this lesson we will deal with non-zero multiples of a number).

4. Display the tables below and elicit the missing non-zero multiples from the students:

Find The First Four Multiples of 10			
10 x 1	10 x 2	10 x 3	10 x 4
10	20		

Find The First Four Multiples of 12			
12 x 1	12 x 2	12 x 3	12 x 4
10	20		

5. Elicit these multiples without using a table:
   List the first 3 non-zero multiples of 4
   List the first 3 non-zero multiples of 22
   List the first 4 non-zero multiples of 15
   List the first 5 non-zero multiples of 55

6. Tell the students that the program they are about to use will teach them now to find the non-zero multiples of a number.

7. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON SKILL 8 and EXERCISE 1.
   After completing EXERCISE 1 student should complete EXERCISE 2 and EXERCISE 3.

8. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. What is the multiple of a number?
2. How do we find the first four non-zero multiples of a number?

Homework: See attached worksheet.

Enrichment:

1. What is the next multiple after the 5th non-zero multiple of 8?
2. What is the next multiple after the 8th non-zero multiple of 12?
3. What is the next multiple after the 3rd non-zero multiple of 48?
4. What is the next multiple after the 12th non-zero multiple of 99?

HOMEWORK ASSIGNMENT

Write the first five non-zero multiples of:

1. 3:_____, _____, _____, _____, _____
2. 4:_____, _____, _____, _____, _____
3. 20:_____, _____, _____, _____, _____
4. 50:_____, _____, _____, _____, _____
5. 9:_____, _____, _____, _____, _____
6. 15:_____, _____, _____, _____, _____
7. 24:_____, _____, _____, _____, _____
8. 36:_____, _____, _____, _____, _____
9. 27:_____, _____, _____, _____, _____
10. 13:_____, _____, _____, _____, _____

11. What is the next multiple of 2 that comes after 12?_____
12. What is the next multiple of 3 that comes after 21?_____
13. What is the next multiple of 6 after 36?_____
14. What is the next multiple of 8 that comes after 48?_____
15. What is the next multiple of 10 that comes after 120?_____
16. What is the next multiple of 7 that comes after 49?_____
17. What is the next multiple of 12 that comes after 108?_____
18. What is the next multiple of 5 that comes after 45?_____
19. What is the next multiple of 11 after 121?_____
20. What is the next multiple of 13 that comes after 65?_____

TOPIC 42: Simplifying Fractions to Lowest Terms

Aim: How do we simplify fractions to lowest terms?

Performance Objectives: Students will be able to:

- find the GCF of the numerator and denominator
- simplify the fractional part of a mixed number
- simplify the fraction by dividing the numerator and the denominator by the GCF

Materials:

- Apple IIe or Apple IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

Motivation:

What is the Greatest Common Factor of 6 and 18?

Development:

1. Elicit from the students the procedure for finding the GCF of two numbers:
   a) list all of the factors of the two numbers.
   b) list all of the common factors of the two numbers.
   c) choose the largest common factor, which we call the GCF of the two numbers.

2. Explain that to simplify a fraction we must:

   a) find the GCF of the numerator and the denominator
   b) simplify the fraction by dividing the numerator and the denominator by the GCF.

3. Simplify: $\frac{6}{9}$

   Factors of 6 = 1, 2, 3, 6 GCF = 3
   Factors of 9 = 1, 3, 9

   $\frac{6}{9} = \frac{6 \div 3}{9 \div 3} = \frac{2}{3}$

4. Simplify $\frac{8}{20}$

   Factors of 8 = 1, 2, 4, 8, GCF = 4
   Factors of 20 = 1, 2, 4, 5, 10, 20

   $\frac{8}{20} = \frac{8 \div 4}{20 \div 4} = \frac{\boxed{}}{5}$

   The missing number is 2 and $\frac{8}{20} = \frac{2}{5}$

5. Simplify $2\frac{6}{9}$

   $2\frac{6}{9} = 2\frac{2}{3}$ (HINT: See Development #3)

   b) Simplify $7\frac{8}{12}$

   $7\frac{8}{12} = 7\frac{2}{5}$ (Hint: See Development)

   c) Simplify $\frac{132}{156}$ (Hint: See Motivation)

6. Tell the students that the program they are about to use will teach them to simplify fractions to lowest terms.

7. When the "Fractions Basic Skills" Disk is booted a menu appears; students should select LESSON, SKILL 7 and EXERCISE 1. After completing EXERCISE 1, students should complete EXERCISE 2 and EXERCISE 3.

8. If a student misses two lessons in a row, an automatic help lesson is performed.

9. After completing SKILLS 5-7, student can complete REVIEW 2.

Summary:

1. How do we find the GCF of the numerator and the denominator of a fraction?
2. How do we simplify a fraction?
3. How do we simplify the fractional part of a mixed number?

Homework: See attached worksheet.

Enrichment:

Simplify: $\frac{144}{168}$ $\frac{75}{225}$ $\frac{512}{625}$

HOMEWORK ASSIGNMENT

Fill in the missing numbers:

1. $\frac{8}{10} = \frac{8 \div 2}{10 \div 2} = \frac{\square}{5}$

2. $\frac{12}{18} = \frac{12\,\square}{12\,\square} = \frac{2}{\square}$

Simplify each fraction to lowest terms:

3. 8/12 =

4. 12/16 =

5. 15/20 =

6. 12/24 =

7. 24/36 =

8. 24/30 =

9. 33/44 =

10. 36/48 =

Simplify each mixed number to lowest terms:

11. 3 6/9 =

12. 4 6/8 =

13. 9 4/8 =

14. 7 8/10 =

15. 14 12/16 =

16. 8 12/18 =

17. 22 18/27 =

18. 21 33/36 =

19. 5 24/48 =

20. 6 48/72 =

TOPIC 43: Finding the Least Common Multiple (LCM) of Two Numbers

Aim: How do we find the Least Common Multiple (LCM) of two numbers?

Performance Objectives: Students will be able to:

- list the multiples of two numbers
- define the term Least Common Multiple (LCM)
- find the Least Common Multiple (LCM) of two numbers

Materials:

- Apple IIe or IIc, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

What are the first 5 non-zero multiples of 24?
What are the first 5 non-zero multiples of 36?

Development:

1. Display on the chalkboard the list of multiples of 3 and the list of multiples of 4.
   The list of the multiples of 3 is (3,6,9,12,...)
   The list of the multiples of 4 is (4,8,12,16...)
   (NOTE: We will deal with non-zero multiples only)

2. Elicit from students which number is the smallest multiple common to the two numbers. (12) 12 is called the Least Common Multiple (LCM) of 3 and 4.

3. **Definition:** The smallest non-zero number that is a multiple of two numbers is called the Least Common Multiple (LCM) of those numbers.

4. Guiding students through these two examples ask the students to

   a) find the LCM of: 3 and 5
      The list of the multiples of 3 is (3,6,9,12,15,...)
      The list of the multiples of 5 is (5,10,15,...)
      LCM of 3 and 5 is 15

   NOTE: If the numbers are relatively prime then the LCM is the product of the two numbers. 3 and 5 are relatively prime because their GCF is 1. Therefore, the LCM of 3 and 5 is 3 x 5 or 15

   b) find the LCM of 4 and 6
      The list of the multiples of 4 is (4,8,12,..)
      The list of the multiples of 6 is (6,12,...)
      LCM of 4 and 6 is 12

   c) Ask the class to find the LCM of the motivation.

   d) Ask the students to find the LCM of 24 and 36.
      The list of the multiples of 24 is (24,48,72,96,120,144..)
      The list of the multiples of 36 is (36,72,108,144,180...)
      LCM of 24 and 36 is 72

5. Tell the students that the program they are about to use will teach them how to find the Least Common Multiple (LCM) of two numbers.

6. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON SKILL 9 and EXERCISE 1, after completing EXERCISE 1, the student should complete SKILL 10 EXERCISE 1

7. If a student misses two examples in a row, an automatic help lesson is performed.

Summary:

1. How do we list the multiples of two numbers?
2. What is the Least Common Multiple?
3. What is the Least Common Multiple of two numbers?

Homework: See attached worksheet.

Enrichment:

Name two important facts about the year represented by the Least Common Multiple of 497 and 4.

Homework Assignment

Find the Least Common Multiple (LCM), after listing the multiples of these numbers:

1.
3: ________

4: ________

LCM = ________

2.
4: ________

5: ________

LCM = ________

3.
8: ________

10: ________

LCM = ________

4.
12: ________

18: ________

LCM = ________

5.
25: ________

35: ________

LCM = ________

6.
8: ________

12: ________

LCM = ________

7.
15: ________

18: ________

LCM = ________

8.
15: ________

45: ________

LCM = ________

9.
24: ________

36: ________

LCM = ________

10.
32: ________

48: ________

LCM = ________

TOPIC 44: Finding the Least Common Multiple (LCM) of Three Numbers

Aim: How do we find the Least Common Multiple (LCM) of three numbers.

Performance Objectives: Students will be able to:

- list the multiples of three numbers
- find the Least Common Multiple (LCM) of three numbers

Materials

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

Motivation:

What are the first twelve multiples of 10?
What are the first ten multiples of 12?
What are the first ten multiples of 15?
How can knowing the answers help you find the LCM of 10, 12, and 15?

Development:

1. Review the method for finding the Least Common Multiple (LCM) of two numbers. Display on the chalkboard the list of multiples of 3 and the list of multiples of 4.
   The list of the multiples of 3 is (3,6,9,12, ...)
   The list of the multiples of 4 is (4,8,12,...)

2. Elicit from students that the Least Common Multiple (LCM) of 3 and 4 is 12.

3. Elicit from the students the multiples of 4, 5, and 10.
   The list of the multiples of 4 is (4,8,12,16,20,..)
   The list of the multiples of 5 is (5,10,15,20,....)
   The list of the multiples of 10 is (10,20,..)

4. Elicit from the students that the Least Common Multiple (LCM) of 4, 5 and 10 is 20.

5. Guiding students have them find the LCM of:
   a) 3, 5 and 6
      Multiples of 3: (3,6,9,12,15,18,21,24,27,30,...)
      Multiples of 5: (5,10,15,20,25,30,..)
      Multiples of 6: (6,12,18,24,30,..)
      LCM of 3, 5, 6, = 3

   b) 3, 4 and 6
      Multiples of 3: (3,6,9,12,...)
      Multiples of 4: (4,8,12,...)
      Multiples of 6: (6,12,....)
      LCM of 3,4, and 6 = 12

   c) 10, 12, and 15 (use Motivation answers)
      Multiples of 10: (10,20,30,40,50,60,70,80,90,100,110,120,...)
      Multiples of 12: (12,24,36,48,60,72,84,96,108,120,.....)
      Multiples of 15: (15,30,45,60,75,90,105,120,...)
      LCM of 10, 12, and 15 = 120

6. Tell the students that the program they are about to use will teach them how to find the Least Common Multiple (LCM) of three numbers.

7. When the "Fractions Basic Skills" disk is booted a menu appears. Students should select Lesson Skill 9, Exercise 2 and Exercise 3.

8. If a student misses two examples in a row, an automatic help lesson is performed.

Summary:

1. How do we list the multiples of a number?
2. How do we list the multiples of three numbers?
3. What is the Least Common Multiple of three numbers?

Homework: See attached worksheet.

Enrichment:

What is the LCM of 10, 20, and 30?
What is the LCM of 72, 96, and 144?
What is the LCM of 15, 25, and 35?
What is the LCM of 11, 13, and 7?

Homework Assignment

Find the Least Common Multiple (LCM) after listing the multiples of these numbers:

1. 2:________
3:________
6:________
LCM =________

2. 3:________
4:________
12:________
LCM =________

3. 3:________
8:________
10:________
LCM =________

4. 4:________
6:________
8:________
LCM =________

5. 5:________
6:________
10:________
LCM =________

6. 6:________
10:________
15:________
LCM =________

7. 15:________
20:________
30:________
LCM =________

8. 12:________
18:________
9:________
LCM =________

9. 8:________
24:________
36:________
LCM =________

10. 24:________
36:________
48:________
LCM =________

TOPIC 45: Changing Fractions Into Equivalent Fractions

Aim: How do we change a fraction into one of equivalent value?

Performance Objectives: Students will be able to:

- identify equivalent fractions using shaded regions
- create equivalent fractions by multiplying the denominator and numerator of a given fraction by the same, non-zero number
- recognize that equivalent fractions are formed by multiplying by a fraction equal to one

Vocabulary:

Equivalent fractions, non-zero number

Materials:

- MS DOS computers with 64K and Color/Graphics Monitor Adapter
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath
- MS DOS diskette with BASICA
- worksheet with rectangular rods of same size.
- class set of rulers

Motivation:

Using rectangular rods of the same size, shade in the region that represents the fractions: 1/2, 2/4, 3/6, 4/8. Compare the shaded portions.

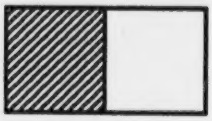
Development:

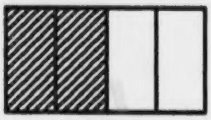
1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1, type A and press ENTER. When asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For the last three prompts, type N and ENTER for each. Follow the screen instructions for putting management information on lesson disks.

   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit the diagrams which represent each fraction.


1/2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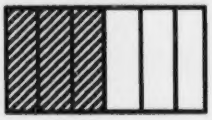
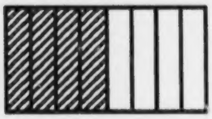

3/6


4/8

3. Elicit from the class that the shaded portions representing the fractions cover the same part of each unit.

4. Tell the class that fractions which name the same shaded regions are called equivalent fractions.

These fractions are equal in value:

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$$

5. Before the class uses the computers the teacher should review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)
   The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. They will then proceed to the next screen which will ask them to: "Type the number of the lesson you want." Have the class type "2", then ENTER.

6. The students will see two partially shaded rods. These rods are divided into a number of parts, but they are equivalent. The two rods will be given fraction names, and the student is told that these two fractions are equivalent.

   If a student makes a mistake, the tutorial screen will list key elements of a ratio. If another mistake is made, the solution is given and the student moves on to the next problem.

   When the screen appears showing the number of correct out of 4, you can check their resultS. After you clarify any misunderstandings, you may have them do more problems by typing Y, ENTER.

7. Allow students about 10-15 minutes to complete the computer-directed activity.

8. After the students have returned to teacher-centered activities, have them do the following: a) 8×1 b) $\frac{1}{4} \times 1$ c) $\frac{2}{3} \times 1$

   Elicit the generalization that the product of a number and one equals the number.

9. Have the students do the following:

   a) $\frac{4}{4} =$ b) $\frac{5}{5} =$ c) $\frac{12}{12}$

   If need be, have the students shade in rods to help solve the questions. Elicit the generalization that any fraction having the same (non-zero) number for its numerator and denominator is equal to one.

   $$\frac{4}{4} = \frac{5}{5} = \frac{12}{12} = 1$$

10. Have the students complete the following:

$$\frac{1}{2} \times \frac{2}{2} = \frac{1 \times 2}{2 \times 2} = \frac{\boxed{}}{\boxed{}}$$

$$\frac{3}{4} \times \frac{2}{2} = \frac{3 \times 2}{4 \times 2} = \frac{\boxed{}}{\boxed{}}$$

$$\frac{4}{5} \times \frac{2}{2} = \frac{4 \times 2}{5 \times 2} = \frac{\boxed{}}{\boxed{}}$$

11. Have the students return to the computers and go to the next part of the lesson by pressing N and ENTER.

    The student will be given an example using the equivalence algorithm.

    $$\frac{a}{b} = \frac{a \times c}{b \times c} = \frac{ca}{cb} \quad \text{e.g. } \frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$$

    The first example has a fraction and an equivalent fraction is then found.

12. The key elements of an equivalence algorithm will help students if they make a mistake. If the student makes the mistake again, the screen will explain the solution and give the answer, then go on to the next problem.

    At this point the computer-centered lesson will end.

13. Have students remove the disks from the machines, and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

14. Elicit the generalization that equivalent fractions can be obtained by multiplying the numerator and denominator by the same (non-zero) number or by dividing the numerator and denominator by the same (non-zero) number.

Summary:

1. How do you identify equivalent fractions in shaded drawings?
2. How do you create equivalent fractions?

Homework:

Choose appropriate problems from students' textbook.

Enrichment:

What are five equivalent fractions for the following:

a) $\frac{1}{6}$ b) $\frac{2}{5}$ c) $\frac{3}{8}$

TOPIC 46: Simplifying Rational Numbers in Fraction Form

Aim: How do we simplify fractions into lowest terms?

Performance Objectives: Students will be able to:

- simplify fractions into lowest terms
- state the method for simplifying fractions

Vocabulary: Simplest form, lowest terms

Materials:

- MS DOS computers with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath

Motivation:

Find the numerator of a fraction whose denominator is 5 and which is equivalent to $\frac{8}{10}$.

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears on the screen, select option 1, type A and press ENTER. Type MATH for GROUP NAME. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES, type MATH again. For the last three prompts, type N and ENTER.
   Follow the screen instructions for putting management information on lesson disks.

2. Elicit that 5 is 1/2 of 10 or that $10 \div 2 = 5$ and therefore the missing numerator is 1/2 of 8 or $8 \div 2$.

   Alternate method: Elicit the proportion and have the students solve it.

   $$\frac{\square}{5} = \frac{8}{10}$$

3. Have the students draw shaded rods to show that the fractions are equivalent.

4. Have the students find the missing part:

   $$\frac{3}{4} = \frac{\square}{8} \qquad \frac{4}{8} = \frac{\square}{2} \qquad \frac{6}{10} = \frac{3}{\square}$$

5. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.

Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Have the class type 2, then ENTER for lesson number.

6. Have the students go through the first randomized part of the lesson as a review.

   After the first four questions, a score will be given. Students should then type N, and ENTER.

7. The student will then be given examples of how an equivalent fraction is found.

8. The next example gives an equivalent fraction which is then reduced to simplest form. The following algorithm is used:

   $\frac{ca}{cb} = \frac{a \times c}{b \times c} = \frac{a}{b}$ ex. $\frac{6}{9} = \frac{2 \times 3}{3 \times 3} = \frac{2}{3}$

   After completing two problems a score will be given. Have students type N, and ENTER to go on to the reducing fractions part of the program.

9. If the student makes a mistake while doing the four-problem drill, a tutorial screen will remind the student of the key elements of the equivalence algorithm, and ask the student to try again.
   If the student makes the mistake again, the screen will explain the solution, give the answer, and then go on to the next problem.

   After four problems, a score will appear. Have students type Y to do more of the same type of problems or N to continue.

   The students will then go on to an accuracy check. When they finish, the students are told if they have achieved mastery of the skills, or need to repeat the lesson.

10. Allow students about 10-15 minutes to complete the computer-directed activity.

    Have students remove the disks from the machines, and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Which of the following are in simplest forms?
   a) $\frac{6}{8}$ b) $\frac{3}{4}$ c) $\frac{5}{8}$ d) $\frac{12}{8}$
2. How do we simplify a fraction?

Homework:

The teacher should choose appropriate problems from the students, textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

What number could we subtract from the numerator and denominator of $\frac{10}{19}$ so that the value of the new fraction would be equal to $\frac{1}{2}$?

TOPIC 47: Writing an Improper Fraction as a Whole Number or Mixed Number

Aim: How to write an improper fraction as a whole number or mixed number?

Performance Objectives: Students will be able to:

- identify an improper fraction
- write an improper fraction as a mixed number or
- write an improper fraction as a whole number

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

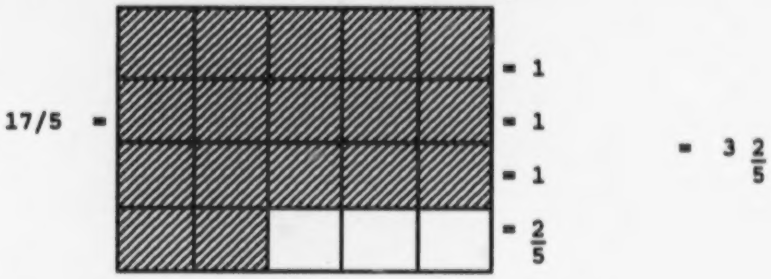
Motivation:

What is the value of 11 quarters or 11/4? (\$3 $\frac{3}{4}$)

Development:

1. Elicit from students the definition of improper fraction. An improper fraction is a fraction whose numerator is greater than its denominator.

2. Elicit from students the procedure to write an improper fraction as a whole number or mixed number: Display this diagram on the chalkboard. Elicit the explanation of how $\frac{17}{5} = 3\frac{2}{5}$ using the diagram.



3. Elicit a shortcut method for arriving at the above answer. Method: Group 17/5 by 5. How many fives are in 17/5. Divide the numerator by the denominator.

$$\begin{array}{r} 3R2 \\ 5\overline{)17} \end{array} = 3\frac{2}{5}$$

4. Guide the students through these practice examples:

a) Simplify $\frac{11}{4} = \begin{array}{r} 3R3 \\ 4\overline{)11} \end{array} = 3\frac{3}{4}$

b) Simplify $\frac{15}{2} = \begin{array}{r} 7R1 \\ 2\overline{)15} \end{array} = 7\frac{1}{2}$

c) Simplify $\frac{18}{3} = \begin{array}{r} 6R0 \\ 3\overline{)18} \end{array} = 6$

d) Simplify $\frac{9}{6} = \begin{array}{r} 1R3 \\ 6\overline{)9} \end{array} = 1\frac{3}{6} = 1\frac{1}{2}$

5. Tell the students that the program they are about to use will teach them to write an improper fraction as a whole number or mixed number.

6. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON, SKILL 14 and EXERCISE 1. After completing EXERCISE 1, student should complete EXERCISE 2 and EXERCISE 3.

7. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we identify an improper fraction?
2. How do we write an improper fraction as a mixed number?
3. When can an improper fraction be changed to a whole number?

Homework: See attached worksheet

Enrichment:

Write these examples as improper fractions and mixed numbers before you find the monetary value:

a) What is the value of 25 dimes?
b) What is the value of 255 quarters?
c) What is the value of 352 nickels? (be careful)
d) What is the value of 756 pennies? (be careful)

HOMEWORK ASSIGNMENT

Write these improper fractions as whole numbers or mixed numbers in lowest terms?

1. 12/3 =
2. 15/8 =
3. 9/4 =
4. 17/12 =
5. 13/5 =
6. 27/9 =
7. 99/10 =
8. 53/7 =
9. 32/6 =
10. 14/2 =
11. 55/11 =
12. 72/13 =
13. 52/3 =
14. 11/2 =
15. 21/5 =
16. 28/3 =
17. 59/7 =
18. 93/7 =
19. 34/11 =
20. 137/16 =

TOPIC 48: Comparing Rational Numbers in Fraction Form

Aim: How do we compare fractions with shaded rods?

Performance Objectives: Students will be able to:

- compare two fractions represented by shaded rods
- define greater than (>)
- define less than (<)
- state the procedure used to compare two fractions

Materials:

- MS DOS computers with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath
- worksheet with pre-drawn rods
- class set of rulers

Motivation:

Two students were trying out for the track team. In the same length of time, Jack ran $\frac{5}{8}$ of a mile, and Jill ran $\frac{3}{4}$ of a mile. Who ran farther? Use a shaded rod for each fraction to answer this question.

Development:

1. If you have not prepared the software for classroom use, follow the procedure below:

   Place the management disk in drive A. When the main menu appears, select option 1, type A and press ENTER. When asked to type GROUP NAME use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES, type A and press ENTER. For the last three prompts, type N and ENTER for each. Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we can compare two fractions by looking at a shaded representation.

   Give out the worksheet and have the students represent $\frac{5}{8}$ and $\frac{3}{4}$ as shaded rods.

   Elicit the answer to the motivation question.

3. Review the meaning of '>' (greater than) and '<' (less than).

4. Show the student that $\frac{5}{8}$ is less than $\frac{3}{4}$ and can be written as '$\frac{5}{8} < \frac{3}{4}$'

5. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.

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Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down Control and type the letter T simultaneously. On the next screen they will type 3 then ENTER for the lesson number.

6. The student will see a pair of partially shaded rods and will be given the fractions they represent. The shaded regions of the rods are compared, and from this observation it is stated that the first fraction is greater (>) than the second fraction.
   Another pair of rods and fractions is presented in a similar fashion, this time demonstrating the lesser than sign (<).
   The student is then given five problems with the rod divided, (but not shaded) and the two fractions represented by the rods. The student is then asked to enter > or < .
   NOTE - In order to enter either > or < the shift key must be depressed at the same time as the sign. If the student makes a mistake, the rods are shaded in and the answer is given. The next problem will then appear.

7. Allow students about 10-15 minutes to complete the computer-directed activity.

   At the end of the session instruct the students to remove the disks from the machines, and turn off the computers. Have the students put the diskettes into their protective covers carefully.

Summary:

1. Which is greater: $\frac{4}{5}$ or $\frac{3}{4}$?
2. Elicit the method for comparing two fractions by means of shaded rods.

Homework:

Have students read the section in their math book dealing with comparing fractions.

See attached worksheet.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

What happens to the value of a fraction if the denominator remains the same but the numerator gets larger?

Consider: $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}$, etc.

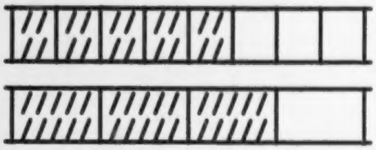
What happens to a fraction if the numerator remains the same but the denominator gets larger?

Consider: $\frac{2}{3}, \frac{2}{4}, \frac{2}{5}, \frac{2}{6}, \frac{2}{7}$, etc.

HOMEWORK ASSIGNMENT

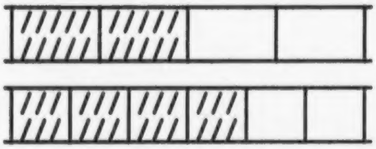
I. Given the following divided rods, compare the fractions they represent (use < or >).

a.



$\frac{5}{8} \bigcirc \frac{2}{4}$

b.



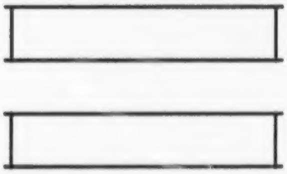
$\frac{2}{4} \bigcirc \frac{4}{6}$

II. Draw the shaded rods to represent the fractions below, and compare them.

a.

$\frac{2}{3} \bigcirc \frac{3}{4}$

b.



$\frac{1}{2} \bigcirc \frac{1}{4}$

III. Use shaded rods to solve the following problems:

a. In one minute a horse ran 7/8 of a mile, and a lion ran 5/6 of a mile. Which animal ran farther?

b. In six months, Speedy Steve's Construction Company built 9/12 of a skycraper uptown. In the same amount of time, Lazy Lou Construction Co. built 4/5 of a skyscraper downtown. If the buildings are going to be the same height when they are finished, who got more work done, Speedy Steve or Lazy Lou?

TOPIC 49: Comparing Fractions With Like or Unlike Denominators

Aim: How can we compare fractions with like or unlike denominators?

Performance Objectives: Students will be able to:

- identify like denominators
- state the procedure used to compare two fractions with like denominators
- find the common denominator of two fractions
- state the method for finding the common denominator of two fractions
- create equivalent fractions with like denominators for two given fractions with unlike denominators
- state the procedure for comparing two fractions with unlike denominators

Vocabulary:

Like denominators, unlike denominators, Common denominator, Least Common Denominator

Materials:

- MS DOS computers with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath

Motivation:

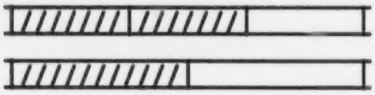
Which fraction is greater: $\frac{1}{2}$ or $\frac{2}{3}$?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A, when the main menu appears select option 1 and type "A" and press ENTER. When asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES type A and ENTER. For the last three prompts, type N and ENTER. Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we could solve the problem by representing the fractions as shaded rods and then comparing them.

   Elicit $\frac{2}{3}$ is greater than $\frac{1}{2}$. Elicit the inverse. ($\frac{1}{2}$ is less than $\frac{2}{3}$)

3. Have the class compare $\frac{6}{8}$ and $\frac{5}{8}$ by using shaded rods.

   Elicit that $\frac{6}{8} > \frac{5}{8}$

   Elicit that the denominators of the fractions are the same.

4. Compare $\frac{8}{13}$ and $\frac{7}{13}$.   Elicit $\frac{8}{13} > \frac{7}{13}$.

   Elicit the reason for this is that since the fractions have like denominators and 8 > 7, therefore $\frac{8}{13} > \frac{7}{13}$.

5. How could we compare $\frac{1}{2}$ and $\frac{2}{3}$ without using shaded rods?

   Elicit that the fractions have unlike [different] denominators and that we must first change them into equivalent fractions with like denominators.

   Briefly review finding a common denominator if necessary. Elicit that in this example, LCD is 6.

   Change $\frac{1}{2}$ to $\frac{3}{6}$ Change $\frac{2}{3}$ to $\frac{4}{6}$

   $\frac{3}{6} < \frac{4}{6}$ therefore $\frac{1}{2}$ is $< \frac{2}{3}$.

6. Before the class uses the computers review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the students press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER
   Type MATH for the group name; ENTER
   Type 1 for the student number; ENTER
   Type A for the password; ENTER
   Type A for the password again; ENTER
   (You may choose a different password.)
   The next screen says: "You are now ready to begin your placement check."
   DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Have them type 3 then press ENTER for the lesson number.

7. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different.

   After the students reach the screen that tells how well they performed, they should type N; ENTER.

8. The students will see several pairs of fractions having the same denominators. The pairs will have the correct '>' or '<' signs between the numbers.

   Then the students are asked to compare ten pairs of fractions with unlike denominators.

   NOTE - In order to enter either < or >, the shift key must be depressed at the same time as the sign.

   If a mistake in doing a problem is made, the computer gives a hint: the common denominator. If a mistake is made again, the numerator is filled in, thus solving the problem.

When the screen appears showing the number correct out of 10, you may either have them do more of the same type of problems by typing Y and pressing ENTER, or have the students enter N, and the program will continue. Next to appear will be the accuracy check. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they should repeat it.

9. Allow students about 10-15 minutes to complete the computer-directed activity.

At the end of the session, instruct the students to remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. Which of the following have like denominators?
   a) $\frac{3}{4}, \frac{1}{4}$ b) $\frac{6}{8}, \frac{3}{4}$ c) $\frac{9}{11}, \frac{3}{11}$ d) $\frac{4}{12}, \frac{1}{4}$
2. How do we know when fractions have like denominators?
3. Explain how you find the common denominator for $\frac{3}{4}$ and $\frac{1}{3}$.
4. Explain how you would compare $\frac{3}{4}$ and $\frac{1}{3}$.
5. State which of the following is greater than (>), less then (<), or equal to (=):
   a) $\frac{3}{4}$ ___ $\frac{1}{4}$ b) $\frac{6}{8}$ ___ $\frac{3}{4}$ c) $\frac{9}{11}$ ___ $\frac{3}{11}$ d) $\frac{4}{12}$ ___ $\frac{1}{4}$
6. State the procedure used to compare two given fractions.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

What happens to the value of a fraction if the denominator becomes larger while the numerator remains the same?

TOPIC 50: Writing a Whole Number or Mixed Number as an Improper Fraction

Aim: How do we write a whole number or mixed number as an improper fraction?

Performance Objectives: Students will be able to:

- write a whole number as an improper fraction
- write a mixed number as an improper fraction

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

Motivation:

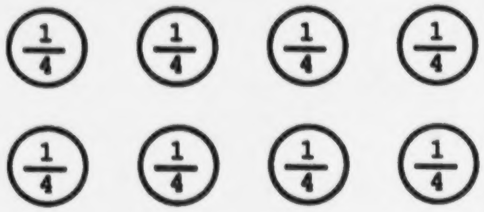
How many quarters are there in \$2? in \$2.75? or $2\frac{3}{4}$?

Development:

1. Elicit from the students the procedure for writing a whole number as an improper fraction. Display this diagram on the chalkboard.

   How many quarters in 1? There are 4 quarters in 1
   How many quarters in 2?

   2 =



   = $\frac{8}{4}$

   or 2 = 2 x 4 fourths = 8 fourths = $\frac{8}{4}$

2. Change 3 into fifths: 3 x 5 - 15/5
   Change 7 into a fraction with the denominator 8: 7 x 8 - 56/8
   Change 10 into a fraction with the denominator 7: 10 x 7 - 70/7
   Change 21 into a fraction with the denominator 3: 21 x 3 - 63/3

3. Elicit from students the procedure for writing 2 3/4 as a fraction:
   The whole number part 2 = 2 x 4 = 8 fourths = 8/4
   Now add the fractional part of 3/4 to the whole number part of 8/4

   $\frac{8}{4} + \frac{3}{4} = \frac{11}{4}$ therefore, $2\frac{3}{4} = \frac{11}{4}$

   or $2\frac{3}{4} = \frac{2}{1} \times \frac{4}{4} + \frac{3}{4} = \frac{8}{4} + \frac{3}{4} = \frac{11}{4}$

4. A shortcut method of changing 2 3/4 into an improper fraction is:
   Multiply the whole number by the denominator and add the numerator.
   2 x 4 + 3 = 11/4

5. Guide the students through these practice examples:

    a) Write $3\frac{5}{7}$ as an improper fraction: $3 \times 7 + 5 = \frac{26}{7}$

    b) Write $6\frac{2}{3}$ as an improper fraction: $6 \times 3 + 2 = \frac{20}{3}$

    c) Write $9\frac{7}{8}$ as an improper fraction: $9 \times 8 + 7 = \frac{79}{8}$

    d) Write $13\frac{3}{4}$ as an improper fraction: $13 \times 4 + 3 = \frac{55}{4}$

6. Tell the students that the program they are about to use will teach them how to write a whole number or mixed number as an improper fraction.

7. When the "Fractions Basic Skills" Disk is booted, a menu appears. Students should select LESSON, SKILL 13 and EXERCISE 1. After completing EXERCISE 1, student should complete EXERCISE 2 and EXERCISE 3.

8. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we write a whole number as an improper fraction?
2. How do we write a mixed number as an improper fraction?

Homework: See attached worksheet

Enrichment:

1. Write $3\frac{4}{5}$ as an improper fraction with a denominator 10.
2. Write $8\frac{3}{4}$ as an improper fraction with a denominator 12.
3. Write $13\frac{2}{3}$ as an improper fraction with a denominator 21.
4. Write $29\frac{7}{8}$ as an improper fraction with a denominator 32.

HOMEWORK ASSIGNMENT

Write these whole numbers or mixed numbers as improper fractions:

1. $7\frac{2}{3}$ =
2. $5\frac{1}{8}$ =
3. $9\frac{1}{2}$ =
4. $17\frac{1}{3}$ =
5. $3\frac{3}{5}$ =
6. 7 =
7. $9\frac{1}{10}$ =
8. $3\frac{7}{8}$ =
9. $5\frac{5}{7}$ =
10. $14\frac{3}{10}$ =
11. 33 =
12. $7\frac{3}{4}$ =
13. $5\frac{5}{12}$ =
14. $11\frac{7}{10}$ =
15. $2\frac{11}{15}$ =
16. $28\frac{2}{7}$ =
17. $12\frac{3}{8}$ =
18. $9\frac{3}{16}$ =
19. $3\frac{4}{11}$ =
20. $13\frac{7}{25}$ =

TOPIC 51: Adding Fractions and Mixed Numerals With Like Denominators

Aim: How do we add fractions and mixed numerals with like denominators?

Performance Objectives: Students will be able to:

- state the procedure for adding fractions with like denominators
- solve problems involving the addition of two fractions with like denominators
- state the procedure for adding fractions and mixed numerals with like denominators
- solve problems involving the addition of fraction and mixed numerals with like denominators

Vocabulary: like denominator

Materials:

- MS DOS computers with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath

Motivation:

In a relay race, the first racer ran $\frac{3}{10}$ of a mile and the second racer ran $\frac{6}{10}$ of a mile. How far did the two racers run?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

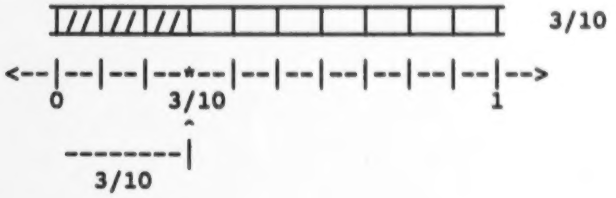
   Place the management disk in drive A. When the main menu appears, select option 1 and type A and press ENTER. When asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names type A and press ENTER. For the last three prompts, type N and ENTER for each. Follow the screen instructions for putting management information on lesson disks.

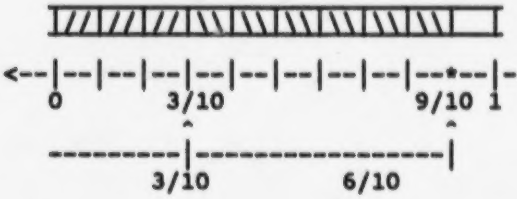
   Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we must add the two distances together.

   Elicit from the class how this problem might be solved with shaded rods or by using the number line.

   Illustrate:





3/10 + 6/10 = 9/10

Have the class find the sum of the following pairs of fractions by the above methods.

a) $\frac{3}{8} + \frac{4}{8}$ b) $\frac{4}{9} + \frac{1}{9}$ c) $\frac{6}{14} + \frac{3}{14}$

Elicit that both methods are time consuming and another method is needed.

3. Elicit from the class that these fractions have like denominators. Review definition.

Elicit the generalization that the sum of fractions with like denominators can be found by first finding the sum of the numerators and writing this sum over the (common) denominator.

$\frac{3}{10} + \frac{6}{10} = \frac{9}{10}$

$\frac{3}{8} + \frac{4}{8} = \frac{7}{8}$

$\frac{4}{9} + \frac{1}{9} = \frac{5}{9}$

$\frac{6}{14} + \frac{3}{14} = \frac{9}{14}$

4. Do the following. Express answers in simplest fraction form.

$\frac{3}{8} + \frac{4}{8}$ $\frac{5}{9} + \frac{1}{9}$ $\frac{5}{12} + \frac{4}{12}$

$\frac{3}{5} + \frac{4}{5}$ $\frac{4}{15} + \frac{7}{15}$ $\frac{5}{2} + \frac{2}{2}$

5. How can we add

$$\begin{array}{r} 2\frac{2}{5} \\ +\ 3\frac{1}{5} \\ \hline \end{array} \;?$$

Review the meaning of mixed numbers.

$2\frac{2}{5} = 2 + \frac{2}{5}$

Elicit that we can add the fractions separately and the whole numbers separately.

$$\begin{array}{rcccc} 2\frac{2}{5} & = & 2 & & \frac{2}{5} \\ +\ 3\frac{1}{5} & = & 3 & + & \frac{1}{5} \\ \hline & = & (2 + 3) & + & (2/5 + 1/5) \\ & & 5 & + & \frac{3}{5} \\ & & & 5\frac{3}{5} & \end{array}$$

6. Do the following:

$$\begin{array}{r} 5\ \frac{3}{9} \\ +\ 4\ \frac{2}{9} \\ \hline \end{array} \qquad \begin{array}{r} 12\ \frac{5}{12} \\ +\ 14\ \frac{6}{12} \\ \hline \end{array}$$

7. Elicit from the class the procedure for finding the sum of two mixed numbers.
   a) add the fractional parts separately
   b) add the whole number parts separately
   c) express the sum as found in parts (a) and (b) as a mixed number.

8. Do the following:

$$\begin{array}{r} 4\ \frac{5}{9} \\ +\ 2\ \frac{4}{9} \\ \hline (\ 6\ \frac{9}{9}) \end{array} \qquad \begin{array}{r} 10\ \frac{7}{12} \\ +\ 4\ \frac{6}{12} \\ \hline (\ 14\ \frac{13}{12}) \end{array}$$

Elicit from the class that the mixed numbers sums for the above problems need to be simplified. How might we go about simplifying the answers?

Elicit that $6\ \frac{9}{9} = 6 + \frac{9}{9}$ and $\frac{9}{9} = 1$, therefore $6\ \frac{9}{9} = 6 + \frac{9}{9} = 6 + 1 = 7$

Similarly show that $14\ \frac{13}{12} = 15\ \frac{1}{12}$

$$14\ \frac{13}{12} = 14 + \frac{13}{12} = 14 + 1\ \frac{1}{12} = 15\ \frac{1}{12}$$

(If necessary review the method for changing an improper fraction ($\frac{13}{12}$) into a mixed number.)

9. Do the following:

$$\begin{array}{r} 15\ \frac{3}{7} \\ +\ 6\ \frac{5}{7} \\ \hline \end{array} \qquad \begin{array}{r} 22\ \frac{8}{10} \\ +\ 10\ \frac{6}{10} \\ \hline \end{array}$$

10. Before the class uses the computers, review the procedures for handling the equipment.

Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER
Type MATH for the group name; ENTER
Type 1 for the student number; ENTER
Type A for the password; ENTER
Type A for the password again; ENTER
(You may choose a different password.)

The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Have them type 1 then press ENTER for the lesson number.

11. The student will see an example in which a number line, divided into sevenths, is used to show that the sum of $\frac{1}{7} + \frac{4}{7} = \frac{5}{7}$.

Four questions will then be given in this form.

NOTE: a) If a mistake is made before ENTER is pressed, use the backspace key to erase.
b) When the answer is requested as a fraction in simplest form, DO NOT simplify to a mixed number at this time.
c) Use a slash, (/) when entering the fraction.

If a mistake is made, a tutorial screen will appear and represent the fraction on the number line. If the student makes the mistake again, the screen will demonstrate the correct answer, then go on to the next problem.

After 4 questions, a score will appear. Have students type Y to practice more examples of the same type, or N to continue.

12. Two examples of addition of mixed numbers will be shown. Six questions will then be given on mixed number addition. When the students enter their answers, they should enter the whole number, and then the simplified proper fraction. If they do not enter it this way, it will be counted as a mistake. If the student makes a mistake, a tutorial screen will appear and review the procedure for addition, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

13. When the screen appears showing the number of correct out of 6, you can check the group's progress. After you clarify any misunderstandings, you may have them do more problems by typing Y; ENTER. If the student enters N, the program will continue. If Y is entered the student stays in the same drill cycle.

    Next to appear will be the accuracy check. If the student passes this first part, the accuracy check continues with Addition of Mixed Numbers. At the end of this sequence, students are told whether they have achieved mastery of the lesson or whether they should repeat it.

14. Allow about 20-25 minutes to complete the computer-directed activity.

    At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. How would we add 6/12 + 5/12?
2. How do we add fractions with like denominators?
3. How would we add 2 3/7 + 3 2/7?
4. How do we add mixed numerals with like denominators?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

__Enrichment:__

See attached worksheet

Solutions for the worksheet:
There is more than one possible arrangement for these two problems. It is suggested that if time permits, the teacher should encourage different solutions.

8/15	1/15	6/15
3/15	5/15	7/15
4/15	9/15	2/15

Elicit from the class how the solution for the mixed number problem can be related to the fraction problem.

8 8/15	1 1/15	6 6/15
3 3/15	5 5/15	7 7/15
4 4/15	9 9/15	2 2/15

ENRICHMENT

Have the students write the following fractions in each box so that the sum of three numbers horizontally, vertically, and diagonally equal 1.

$\frac{1}{15}$, $\frac{2}{15}$, $\frac{3}{15}$, $\frac{4}{15}$, $\frac{5}{15}$, $\frac{6}{15}$, $\frac{7}{15}$, $\frac{8}{15}$, $\frac{9}{15}$

Have the students write the following fractions in each box so that the sum of three numbers horizontally, vertically, and diagonally equal 16.

$1\frac{1}{15}$, $2\frac{2}{15}$, $3\frac{3}{15}$, $4\frac{4}{15}$, $5\frac{5}{15}$, $6\frac{6}{15}$, $7\frac{7}{15}$, $8\frac{8}{15}$, $9\frac{9}{15}$

TOPIC 52: Adding Fractions With Unlike Denominators

Aim: How do we add fractions with unlike denominators?

Performance Objectives: Students will be able to:

- add fractions with unlike denominators.
- state the procedure for adding fractions with unlike denominators.

Vocabulary:

common denominator, least common denominator (LCD) multiple, common multiple, least common multiple (LCM)

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath

Motivation:

Jannis ran 1/4 of a mile to Pedro's house, and then ran 3/6 of a mile to school. How far did she run?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1 and type "A" and press ENTER. When asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES type A and ENTER. For the last three prompts, type N and ENTER. Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we must add the distances together to answer the question. $\frac{1}{4} + \frac{3}{6}$

   Review with the students the difference between like and unlike denominators. Elicit that in this case the denominators are unlike.

   Ask: Since we can only add fractions with the same denominator, how can we add these fractions?

   Elicit that it is necessary to rename the fractions in equivalent fraction form with the same (common) denominator.

3. Review the method for finding a common denominator.

   Review the meaning of multiple. The set of multiples of 6 are:
   {6,12,18,24,30,...}
   The set of multiples of 4 are:
   {4,8,12,16,20,24,...}
   Find the set of common multiples for 6 and 4.
   {12,24,36,...}

Tell the class that the set of common denominators equals the set of common multiples of 6 and 4.

Find the least common multiple of 6 and 4.
LCM = 12
Therefore the least common denominator (LCD) is 12.

[Note: There are other methods for finding a common denominator that the teacher may wish to use. In that case the teacher should modify the lesson accordingly.]

4. Review the method for renaming fractions.

Rename $\frac{1}{4}$ and $\frac{3}{6}$ as equivalent fractions with denominators of 12.

$$\frac{1}{4} = \frac{\square}{12} \qquad\qquad \frac{3}{6} = \frac{\square}{12}$$

$$\frac{1}{4} \times \frac{3}{3} = \frac{\square}{12} \qquad\qquad \frac{3}{6} \times \frac{2}{2} = \frac{\square}{12}$$

$$\frac{1}{4} = \frac{3}{12} \qquad\qquad \frac{3}{6} = \frac{6}{12}$$

As part of the review, have the students explain why $\frac{3}{3}$ was used to rename $\frac{1}{4}$ as $\frac{3}{12}$.

5. Since the students have now renamed 1/4 and 3/6 into fractions with like denominators (3/12 and 6/12), ask the students to solve the motivation problem.

$$\frac{1}{4} + \frac{3}{6} =$$

$$\frac{3}{12} + \frac{6}{12} = \frac{9}{12}$$

Remind the class to simplify the answer.

$$\frac{9}{12} = \frac{3}{4}$$

6. If needed, go through the steps again with the following problem: $\frac{1}{8} + \frac{5}{6}$

7. Elicit, with assistance, the procedures for adding fractions with unlike denominators.
   a) Find the least common denominator.
   b) Rewrite the fractions into equivalent fractions whose denominator is the least common denominator.
   c) Add the equivalent fractions.
   d) Express the sum in simplest form.

8. Before the class uses the computers, review the procedures for handling the equipment.

Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears, have students press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER
Type MATH for the group name; ENTER
Type 1 for the student number; ENTER
Type A for the password; ENTER
Type A for the password again; ENTER
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Have them type 3 then press ENTER for the lesson number.

9. The student is shown an example of fraction addition following the method described above. Two proper fractions with unlike denominators are first renamed as equivalent fractions with a least common denominator, using multiplication by a fractional equivalent of one. After this the two equivalent fractions, now with a new least common denominator, are added in the usual way.

This is followed by a six-problem drill.

NOTE: a) When prompted, "Enter the sum as a fraction in simplest form", the student should enter the numerator, slash (/), and the denominator.
b) Some of the problems will result in improper fractions. The answers must appear as simplified improper fractions, not mixed numbers. Otherwise they will be counted as mistakes.
c) If a mistake is made before the ENTER key is pressed, use the BACKSPACE key to erase.

If a mistake is made during the six-problem drill, a tutorial screen will appear and form the appropriate equivalent fractions with the LCD. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

When the screen appears showing the number of correct out of 6, you can check the groups progress. Ask the students to raise their hands when they reach this point and walk over to check their results. After you clarify any misunderstandings you may have them do more problems by typing Y (ENTER).

NOTE: The student may stay in this drill cycle as long as you wish, simply by entering "Y" each time this screen appears. The problems are randomized.

If no further practice is desired, leave the computers at this point, since the lesson may be continued at another time.

10. Allow about 10-15 minutes to complete the computer-directed activity.

At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

Have the students explain the steps used in adding fractions with unlike denominators.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

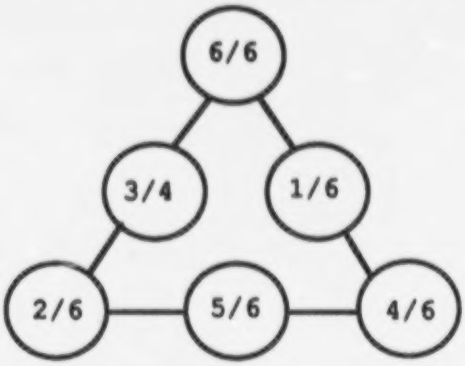
See attached worksheet

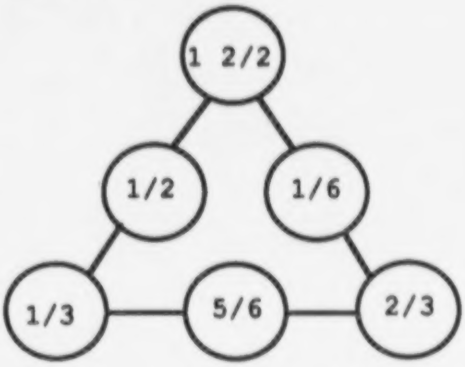
Solutions:

1. Have the students change all the fractions to their equivalent form with a denominator of 6.

   $\frac{1}{2} = \frac{3}{6}$ $\frac{1}{6} = \frac{1}{6}^*$ $\frac{1}{3} = \frac{2}{6}$ $\frac{2}{2} = \frac{6}{6}$ $\frac{2}{3} = \frac{4}{6}$ $\frac{5}{6} = \frac{5}{6}^*$

   * note: There is no change for 1/6 and 5/6.





2. Have the students change the fractions to their equivalent forms with a denominator of 12.

   $\frac{2}{3}, \frac{1}{3}, \frac{3}{4}, \frac{7}{12}, \frac{1}{12}, \frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{5}{12},$

   $\frac{2}{3} = \frac{8}{12},$ $\frac{1}{3} = \frac{4}{12},$ $\frac{3}{4} = \frac{9}{12},$ $\frac{7}{12} = \frac{7}{12}^*,$ $\frac{1}{12} = \frac{1}{12}^*,$

   $\frac{1}{2} = \frac{6}{12},$ $\frac{1}{4} = \frac{3}{12},$ $\frac{1}{6} = \frac{2}{12},$ $\frac{5}{12} = \frac{5}{12}^*$

* There is no need to rename these fractions.

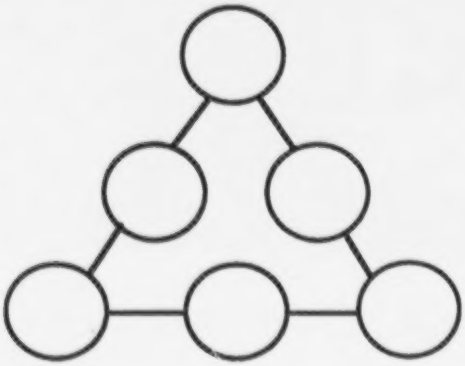
8/12	1/12	6/12
3/12	5/12	7/12
4/12	9/12	2/12

2/3	1/12	1/2
1/4	5/12	7/12
1/3	3/4	1/6

ENRICHMENT

Have the students write the following fractions in each circle so that the sum of each side of the triangle is equal to 11/6.

$\frac{1}{2}, \frac{1}{6}, \frac{1}{3}, \frac{2}{2}, \frac{2}{3}, \frac{5}{6}$



Have the students write the following fractions in each box so that the sum of three numbers horizontally, vertically, and diagonally equal to 15/12.

$\frac{2}{3}, \frac{1}{3}, \frac{3}{4}, \frac{7}{12}, \frac{1}{12}, \frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{5}{12},$

TOPIC 53: Addition of Mixed Numbers With Unlike Denominators

Aim: How do we add mixed numbers with unlike denominators.

Performance Objectives: Students will be able to:

- add mixed numbers with unlike denominators.
- state the procedure for adding mixed numbers with unlike denominators.

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System by D.C. Heath Fractions Disk Part 2

Motivation:

Heather practiced on her guitar for 1-1/2 hours on Monday and 1-1/4 hours on Tuesday. How many hours did she practice altogether?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A, when the main menu appears select option 1 and type "A" and press ENTER. When asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES type A and ENTER. For the last three prompts, type N and ENTER. Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we must add the distances together to answer the question. $1\frac{1}{2} + 1\frac{1}{4}$

   Review with the students the difference between like and unlike denominators.
   Elicit that in this case, the denominators of the fractional part of the mixed numbers are unlike.

   Elicit that it is necessary to rewrite the fractional parts in equivalent fraction form with the same (common) denominator.

   Review the method for finding a common denominator. Find the least common multiple of 2 and 4.
   LCM = 4
   Therefore the least common denominator (LCD) is 4.

   Review the method for renaming fractions. Rename $\frac{1}{2}$ and $\frac{1}{4}$ as equivalent fractions with denominators of 4.

   $$\frac{1}{2} = \frac{\square}{4} \qquad \frac{1}{4} = \frac{\square}{4}$$

   $$\frac{1}{2} = \frac{1}{4} \qquad \frac{1}{4} = \frac{1}{4}$$

   Remind the student that there is no need to change $\frac{1}{4}$ since it is already in the desired form.

   PROBLEM LCD = 4

$$\begin{array}{r} 1\frac{1}{2} \\ +\ 1\frac{1}{4} \\ \hline \end{array} \qquad \begin{array}{l} \frac{1}{2}\times\frac{2}{2}=\frac{2}{4} \\ \frac{1}{4}\qquad=\frac{1}{4} \end{array} \qquad \begin{array}{r} 1\frac{2}{4} \\ +\ 1\frac{1}{4} \\ \hline 2\frac{3}{4} \end{array}$$

3. Have the students do the following:

$$\begin{array}{r} 4\frac{3}{4} \\ +\ 2\frac{3}{5} \\ \hline \end{array} \qquad\qquad \begin{array}{r} 23\phantom{\frac{5}{9}} \\ +\ 12\frac{5}{9} \\ \hline \end{array}$$

Give the students sufficient time to solve the problems. In going over the problems, emphasize the method used in number 2 for solving the problem.

PROBLEM LCD = 20

$$\begin{array}{r} 4\frac{3}{4} \\ +\ 2\frac{3}{5} \\ \hline \end{array} \qquad \begin{array}{l} \frac{3}{4}\times\frac{5}{5}=\frac{15}{20} \\ \frac{3}{5}\times\frac{4}{4}=\frac{12}{20} \end{array} \qquad \begin{array}{r} 4\frac{15}{20} \\ +\ 2\frac{12}{20} \\ \hline 6\frac{27}{20} \end{array}$$

Remind the class to simplify the answer.

$$\begin{aligned} 6\frac{27}{20} &= 6 + \frac{27}{20} \\ &= 6 + \frac{20}{20} + \frac{7}{20} \\ &= 6 + 1 + \frac{7}{20} \\ &= 7\frac{7}{20} \end{aligned}$$

PROBLEM LCD = 9

$$\begin{array}{r} 23\phantom{\frac{5}{9}} \\ +\ 12\frac{5}{9} \\ \hline \end{array} \qquad\qquad \begin{array}{r} 23\phantom{\frac{5}{9}} \\ +\ 12\frac{5}{9} \\ \hline 35\frac{5}{9} \end{array}$$

Note: When adding a whole number to a mixed number, there is no need to find the LCD or to rewrite the fractional part of the mixed number.

4. Elicit the procedures for adding mixed numbers with unlike denominators.
    a) Find the least common denominator
    b) Rewrite the fractional parts of the mixed numbers into equivalent fractions whose denominator is the least common denominator.
    c) Add the equivalent fractions.
    d) Add the whole numbers.
    e) Express the sum in simplest form.

5. Before the class uses the computers, review the procedures for handling the equipment.

Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER
Type MATH for the group name; ENTER
Type 1 for the student number; ENTER
Type A for the password; ENTER
Type A for the password again; ENTER
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Have them type 3, then press ENTER for the lesson number.

6. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different. After the first round of questions, the students will reach the screen that tells them how well they have performed. They should type N and press Enter.

7. Two examples of Addition of Mixed Numbers with Unlike Denominators will be given. Six questions will then be given on mixed number addition. When the students enter their answers, they should enter the whole number, and then the simplified proper fraction. If they do not enter it this way it will be counted as a mistake. If the student makes a mistake, a tutorial screen will appear and review the procedure for converting and addition, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

   When the screen appears showing the number of correct out of 6, you can check the group's progress. After you clarify any misunderstandings, you may have them do more problems by typing Y; Enter. If the student enters N, the program will continue.

8. Next to appear will be the accuracy check. If the student passes this first part, the accuracy check continues with Addition of Mixed Numbers with Unlike Denominators. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they should repeat it.

9. Allow about 20-25 minutes to complete the computer-directed activity. At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

Have the students list the steps used in adding mixed numbers with unlike denominators.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

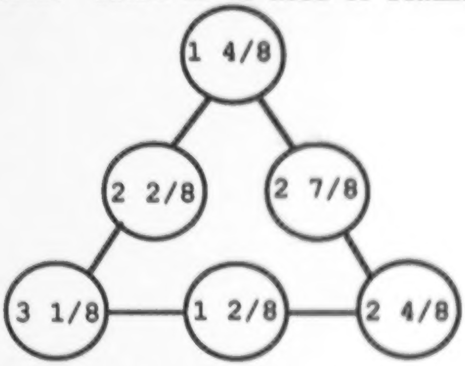
See attached worksheet

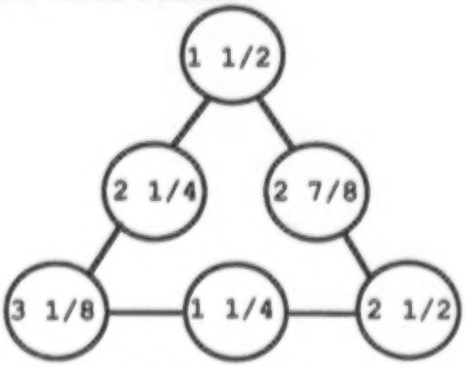
Solutions:

1. $1\frac{1}{2} = 1\frac{4}{8}$ $3\frac{1}{8} = 3\frac{1}{8}$* $2\frac{1}{4} = 2\frac{2}{8}$ $2\frac{1}{2} = 2\frac{4}{8}$ $1\frac{1}{4} = 1\frac{2}{8}$ $2\frac{7}{8} = 2\frac{7}{8}$*

* note: There is no need to rename these mixed numbers.

2\.





3. $8\frac{2}{3} = 8\frac{8}{12}$, $4\frac{1}{3} = 4\frac{4}{12}$, $9\frac{3}{4} = 9\frac{9}{12}$, $7\frac{7}{12} = 7\frac{7}{12}$*, $1\frac{1}{12} = 1\frac{1}{12}$*,

$6\frac{1}{2} = 6\frac{6}{12}$, $3\frac{1}{4} = 3\frac{3}{12}$, $2\frac{1}{6} = 2\frac{2}{12}$, $5\frac{5}{12} = 5\frac{5}{12}$*,

* There is no need to rename these fractions.

8 8/12	1 1/12	6 6/12
3/12	5/12	7/12
4/12	9/12	2/12

8 2/3	1 1/12	6 1/2
1/4	5/12	7/12
1/3	3/4	1/6

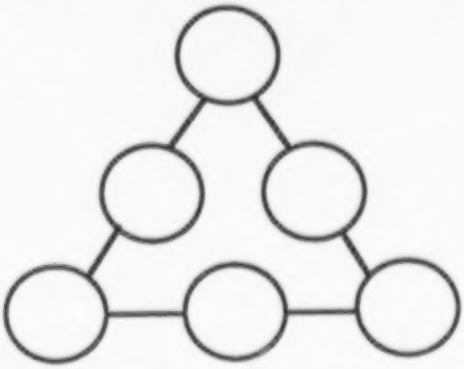
ENRICHMENT

1. Have the students change all the mixed numbers to an equivalent form with a denominator of 8.

   $1\frac{1}{2} =$ $\quad 3\frac{1}{8} =$ $\quad 2\frac{1}{4} =$ $\quad 2\frac{1}{2} =$ $\quad 1\frac{1}{4} =$ $\quad 2\frac{7}{8} =$

2. Have the students write the following mixed numbers in each circle so that the sum of each side of the triangle is equal to $7\frac{7}{8}$.

   $1\frac{1}{4}$, $1\frac{1}{2}$, $2\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{7}{8}$, $3\frac{1}{8}$



3. Have the students change the mixed numbers to their equivalent forms with a denominator of 12.

   $8\frac{2}{3}$, $4\frac{1}{3}$, $9\frac{3}{4}$, $7\frac{7}{12}$, $1\frac{1}{12}$, $6\frac{1}{2}$, $3\frac{1}{4}$, $2\frac{1}{6}$, $5\frac{5}{12}$

Have the students write the following fractions in each box so that the sum of three numbers horizontally, vertically, and diagonally is equal to $16\frac{1}{4}$.

$8\frac{8}{12}$, $9\frac{9}{12}$, $6\frac{6}{12}$, $5\frac{5}{12}$, $3\frac{3}{12}$, $1\frac{1}{12}$, $2\frac{2}{12}$, $7\frac{7}{12}$, $4\frac{4}{12}$,

TOPIC 54: Writing Equivalent Fractions in Higher Terms

Aim: How do we write equivalent fractions in higher terms?

Performance Objectives: Students will be able to:

- state the procedure for writing equivalent fractions in highest terms
- write equivalent fractions in higher terms
- write mixed numbers in higher terms

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- Software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

What are the next 5 fractions in this sequence?

1/2 2/4 3/6 4/8 5/10 ____ ____ ____ ____

Development:

1. Display this example on the chalkboard: $\frac{2}{3} = \frac{\square}{12}$

   Examine the denominators.

   $3 \times \square = 12$ or $12 \div 3 =$
   The missing factor is 4.

   $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

2. Another method is to list equivalent fractions using the identity element of one: 1/1 2/2 3/3 4/4 5/5.....
   Multiply 2/3 by 2/2; then by 3/3; then by 4/4;... and you get these equivalent fractions: 2/3 4/6 6/9 8/12 10/15...
   The equivalent fraction with the denominator of 12 is 8/12.

3. Guide students through these examples which will enable the students to find equivalent fractions.

   a) $\frac{4}{5} = \frac{20}{\square}$

   Examine the numerators
   $4 \times \square = 20$ or $20 \div 4 = \square$
   The missing factor is 5.

   $\frac{4}{5} = \frac{4 \times 5}{5 \times 5} = \frac{20}{25}$

   b) $5\frac{2}{3} = 5\frac{\square}{12}$ See Development 1

   c) $14\frac{4}{5} = 14\frac{20}{\square}$ See Development 2a

3. Tell students that the program they are about to use will teach them how to write equivalent fractions in higher terms.

4. When the "Fractions Basic Skills" Disk is booted, a menu appears. Students should select LESSON, SKILL 11 and EXERCISE 1. After completing EXERCISE 1, student should complete EXERCISE 2 and EXERCISE 3.

5. If a student misses 3 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we divide the given numerators or denominators to find the missing factor?
2. How do we multiply by that factor to find the missing numerator or denominator to write equivalent fractions in higher terms?
3. How do we use the same procedure with mixed numbers?

Homework: See attached worksheet.

Enrichment:

1. Use the identity element of one: 1/1 2/2 3/3 4/4 5/5...
Fill in the missing numbers of these sequences:

a) 4/5, _______, 12/15, _______, _______,
b) _______, _______, 27/30, _______, _______, 54/60
c) _______, _______, 9/☐, _______, _______,☐/24,_______, _______,

HOMEWORK ASSIGNMENT

Fill in the missing number:

1. $\frac{2}{3} = \frac{\underline{\qquad}}{9}$

2. $\frac{5}{8} = \frac{\underline{\qquad}}{16}$

3. $\frac{3}{4} = \frac{12}{\underline{\qquad}}$

4. $\frac{5}{12} = \frac{\underline{\qquad}}{36}$

5. $\frac{3}{5} = \frac{\underline{\qquad}}{20}$

6. $\frac{7}{9} = \frac{\underline{\qquad}}{63}$

7. $\frac{9}{10} = \frac{27}{\underline{\qquad}}$

8. $\frac{3}{7} = \frac{\underline{\qquad}}{28}$

9. $\frac{5}{6} = \frac{25}{\underline{\qquad}}$

10. $\frac{14}{\underline{\qquad}} = \frac{42}{45}$

11. $3\frac{1}{2} = 3\frac{\underline{\qquad}}{8}$

12. $7\frac{3}{4} = 7\frac{\underline{\qquad}}{16}$

13. $5\frac{2}{3} = 5\frac{12}{\underline{\qquad}}$

14. $11\frac{7}{10} = 11\frac{21}{\underline{\qquad}}$

15. $2\frac{1}{5} = 2\frac{8}{\underline{\qquad}}$

16. $28\frac{2}{7} = 28\frac{\underline{\qquad}}{35}$

17. $52\frac{3}{8} = 52\frac{9}{\underline{\qquad}}$

18. $9\frac{5}{9} = 9\frac{\underline{\qquad}}{72}$

19. $3\frac{4}{11} = 3\frac{24}{\underline{\qquad}}$

20. $13\frac{7}{16} = 13\frac{\underline{\qquad}}{64}$

TOPIC 55: Finding Least Common Denominator (LCD) of Two Fractions

Aim: How do we find the Least Common Denominator (LCD) of two fractions?

Performance Objectives: Student will be able to:

- list the multiples of two denominators
- find the Least Common Multiple of two numbers
- recognize the LCM as the LCD of the two fractions

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)]
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

Motivation:

What is the LCM of 25 and 35?

Development:

1. Ask the students to find the LCD of $\frac{2}{3}$ and $\frac{3}{4}$ using the following procedure:
   Display on the chalkboard the list of multiples of 3 and the list of multiples of 4.
   The list of the multiples of 3 is (3, 6, 9, 12,...)
   The list of the multiples of 4 is (4, 8, 12,......)

2. Elicit from students that Least Common Multiple (LCM) of 3 and 4 is 12
   Therefore the LCD of $\frac{2}{3}$ and $\frac{3}{4}$ is 12.

3. Guiding students through these three examples, ask the students to find the LCD of:

   a) Find the LCD of: $\frac{2}{3}$ and $\frac{2}{5}$
      The list of multiples of 3 is (3, 6, 9, 12, 15,...)
      The list of multiples of 5 is (5, 10, 15,......)
      LCM of 3 and 5 = 15
      Therefore the LCD of $\frac{2}{3}$ and $\frac{2}{5}$ is 15

   b) Find the LCD of: $\frac{3}{4}$ and $\frac{5}{6}$
      The list of some multiples of 4 is (4, 8, 12,....)
      The list of some multiples of 6 is (6, 12,....)
      LCM of 4 and 6 = 12
      Therefore the LCD of $\frac{3}{4}$ and $\frac{5}{6}$ is 12

   c) Find the LCD of: $\frac{7}{25}$ and $\frac{9}{35}$ (Use the Motivation answers)

4. Tell the students that the program they are about to use will teach them to find the Least Common Denominator (LCD) of two fractions by finding the Least Common Multiple of their denominators

5. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON, SKILL 10 and EXERCISE 2.

6. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we list the multiples of two denominators?
2. How do we find the Least Common Multiple of those denominators?
3. What is the Least Common Denominator of the two fractions?

Homework: See attached worksheet

Enrichment:

1. What is the LCD of: a) 11/36 and 19/48
   b) 21/49 and 7/28
   c) 13/120 and 5/150

HOMEWORK ASSIGNMENT

Find the Least Common Denominator (LCD) of each pair of fractions:

1.
1/3
3/4
LCD = ________

2.
1/4
3/5
LCD = ________

3.
7/8
3/10
LCD = ________

4.
11/12
11/18
LCD = ________

5.
9/25
17/35
LCD = ________

6.
5/8
7/12
LCD = ________

7.
8/15
11/18
LCD = ________

8.
8/15
19/45
LCD = ________

9.
5/24
13/36
LCD = ________

10.
15/32
23/48
LCD = ________

TOPIC 56: Finding the Least Common Denominator (LCD) of Three Fractions

Aim: How do we find the Least Common Denominator (LCD) of three fractions?

Performance Objectives: Student will be able to

- find the Least Common Multiple (LCM) of three numbers
- find the Least Common Denominator (LCD) of three fractions

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system required 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk.

Motivation:

What is the LCM of 4, 5 and 10?

Development:

1. Ask the students to find the LCD of $\frac{2}{3}$ and $\frac{3}{4}$ using the following procedure: Find the LCM of the denominators.
   Display on the chalkboard the list of multiples of 3 and the list of multiples of 4.
   The list of multiples of 3 is (3, 6, 9, 12,.....)
   The list of the multiples of 4 is (4, 8, 12,....)

2. Elicit from students that the Least Common Multiple (LCM) of 3 and 4 is 12. Therefore the LCD of $\frac{2}{3}$ and $\frac{3}{4}$ is 12.

3. To find the LCD of $\frac{3}{4}$, $\frac{2}{5}$ and $\frac{9}{10}$, (Use the Motivation answers) elicit from the students the multiples of the denominators: 4, 5, & 10.
   The list of the multiples of 4 is (4, 8, 12, 16, 20,....)
   The list of the multiples of 5 is (5, 10, 15, 20,.......)
   The list of the multiples of 10 is (10, 20,......)

4. Elicit from students that the Least Common Multiple (LCM) of 4, 5, and 10 is 20. Therefore the LCD of $\frac{3}{4}$, $\frac{2}{5}$ and $\frac{9}{10}$ is 20

5. Guide students through these two examples asking the students to find the LCD of:

   a) Find the LCD of $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{5}{6}$. First find the LCM of: 3, 5 and 6.
      The list of the multiples of 3 is (3,6,9,12,15,18,21,24,27,30....)
      The list of the multiples of 5 is (5,10,15,20,25,30,......)
      The list of the multiples of 6 is (6,12,18,24,30,......)
      The LCM of 3, 5, and 6 = 30. Therefore the LCD of $\frac{2}{3}$, $\frac{3}{5}$ and $\frac{5}{6}$ = 30

   b) Find the LCD of $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$. First find the LCM of: 3, 4, and 6
      The list of the multiples of 3 is (3,6,9,12,......)
      The list of the multiples of 4 is (4,8,12,.......)
      The list of the multiples of 6 is (6,12,......)
      The LCM of 3, 4, and 6 = 12. Therefore the LCD of $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$ = 12

6. Tell the students that the program they are about to use will teach them how to find the Least Common Denominator (LCD) of three fractions.

7. When the "Fractions Basic Skills" Disk is booted, a menu appears. Students should select LESSON, SKILL 10 and EXERCISE 3.

8. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we list the multiples of three denominators?
2. How do we find the Least Common Multiple of those denominators?
3. What is the Least Common Denominator of the three fractions?

Homework: See attached worksheet

Enrichment:

1. What is the LCD of $\frac{4}{9}$, $\frac{7}{8}$ and $\frac{3}{4}$?
2. What is the LCD of $\frac{5}{6}$, $\frac{3}{5}$, $\frac{1}{2}$ and $\frac{3}{10}$?
3. What is the LCD of $\frac{22}{35}$, $\frac{17}{25}$, $\frac{4}{5}$, $\frac{6}{7}$ and $\frac{9}{10}$?

HOMEWORK ASSIGNMENT

Find the Least Common Denominator (LCD) of the three fractions in each example:

1. 1/2
2/3
5/6
LCD = ________

2. 2/3
3/4
7/12
LCD = ________

3 1/3
1/4
5/12
LCD = ________

4. 1/4
5/6
5/8
LCD = ________

5. 2/5
1/6
7/10
LCD = ________

6. 5/6
7/10
11/15
LCD = ________

7. 8/15
9/20
13/30
LCD = ________

8. 11/12
5/18
5/9
LCD = ________

9. 3/8
17/24
25/36
LCD = ________

10. 23/24
31/36
5/48
LCD = ________

TOPIC 57: Writing Two Fractions as Equivalent Fractions With the Least Common Denominator (LCD)

Aim: How do we write two fractions as equivalent fractions with the Least Common Denominator (LCD)?

Performance Objectives: Students will be able to:

- determine the LCM of the denominators of two fractions
- write two fractions as equivalent fractions with the Least Common Denominator (LCD)

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

1. How do we write $\frac{4}{5}$ as an equivalent fraction with a denominator of 15? with a denominator of 30? with a denominator of 85?

Development:

1. Elicit from the students the method for writing two fractions as equivalent fractions with Least Common Denominator.

   a) Find the LCM of the two denominators. That number is the LCD.
   b) Write the two fractions as equivalent fractions with the Least Common Denominators (LCD).

2. Write $\frac{2}{3}$ and $\frac{3}{4}$ as equivalent fractions with the Least Common Denominator.

   a) Display on the chalkboard the list of multiples of 3 and the list of multiples of 4.
   Multiples of 3: (3,6,9,12,.....)
   Multiples of 4: (4,8,12,......)
   Elicit from students that the Least Common Multiple (LCM) of 3 and 4 is 12
   Therefore the LCD of $\frac{2}{3}$ and $\frac{3}{4}$ is 12

   b) Display on the chalkboard:
   $\frac{2}{3} = \frac{\square}{12}$ Examine the denominators. $3 \times \square = 12$ or $12 \div 3 = \square$
   The missing factor is 4

   $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$ Therefore $\frac{2}{3} = \frac{8}{12}$

   $\frac{3}{4} = \frac{\square}{12}$ Examine the denominators. $4 \times \square = 12$ or $12 \div 4 = \square$
   The missing factor is 3

   $\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$ Therefore $\frac{3}{4} = \frac{9}{12}$

   $\frac{2}{3} = \frac{8}{12}$ and $\frac{3}{4} = \frac{9}{12}$

3. Guide students through this example that asks them to write $\frac{2}{3}$ and $\frac{5}{9}$ as equivalent fractions.

   a) Find the LCD of: $\frac{2}{3}$ and $\frac{5}{9}$

      The list of the multiples of 3 is (3,6,9,12,15,......)
      The list of the multiples of 9 is (9,18,27,......)
      LCM of 3 and 9 = 9
      Therefore the LCD of $\frac{2}{3}$ and $\frac{5}{9}$ is 9

   b) Display on the chalkboard:

      $\frac{2}{3} = \frac{\boxed{}}{9}$ Examine the denominators. $3 \times \boxed{} = 9$ or $9 \quad 3 = \boxed{}$

      The missing factor is __?__. Have class go through the entire procedure.

4. Tell the students that the program they are about to use will teach them how to write two fractions with the Least Common Denominator.

5. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON, SKILL 12 and EXERCISE 1.

6. If a student misses 2 examples in a row, an automatic help lesson is performed.

Summary:

1. How do we determine the LCD of the denominators of two fractions?
2. How do write two fractions as equivalent fractions with the Least Common Denominator (LCD)?

Homework: See attached worksheet

Enrichment:

What is the LCD of two fractions whose denominators are the next two years that will contain 366 days?

HOMEWORK ASSIGNMENT

Change each pair of fractions into equivalent fractions with the Least Common Denominator (LCD):

1.
1/3 = ________
3/4 = ________

2.
1/4 = ________
3/5 = ________

3.
7/8 = ________
3/10 = ________

4.
11/12 = ________
11/18 = ________

5.
9/25 = ________
17/35 = ________

6.
5/8 = ________
7/12 = ________

7.
8/15 = ________
11/18 = ________

8.
8/15 = ________
19/45 = ________

9.
5/24 = ________
13/36 = ________

10.
15/32 = ________
23/48 = ________

TOPIC 58: Writing Three Fractions With the Same Denominators (LCD)

Aim: How do we write three fractions with the same denominators (LCD)?

Performance Objectives: Students will be able to:

- determine the LCD of the denominators of three fractions
- write the fractions as equivalent fractions in higher terms with the same denominators (LCD)

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

What is the LCM of 3, 4, and 6?

Development:

1. Ask the students to write $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$ as equivalent fractions with the same denominators.

   a) Display on the chalkboard the list of multiples of 3; the list of multiples of 4; and the list of multiples of 6. (Use the motivation example.)
   The list of the multiples of 3 is (3,6,9,12,.....)
   The list of the multiples of 4 is (4,8,12,......)
   The list of the multiples of 6 is (6,12,.....)
   Elicit from students that the Least Common Multiple (LCM) of 3, 4, and 6 is 12
   Therefore the LCD of $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$ is 12

   b) Display on the chalkboard:
   $\frac{2}{3} = \frac{\quad}{12}$
   Examine the denominators.
   3 x   = 12 or 12   3 =
   The missing factor is 4

   $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$ Therefore $\frac{2}{3} = \frac{8}{12}$

   $\frac{3}{4} = \frac{\quad}{12}$ Examine the denominators. 4 x   = 12 or 12   4 =
   The missing factor is 3.
   $\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$ Therefore $\frac{3}{4} = \frac{9}{12}$

   $\frac{5}{6} = \frac{2 \times 5}{6 \times 2} = \frac{10}{12}$ Therefore $\frac{5}{6} = \frac{10}{12}$
   $\frac{5}{6} = \frac{\quad}{12}$ Examine the denominators. 6 x   = 12 or 12   6 =
   The missing factor is 2.
   $\frac{5}{6} = \frac{2 \times 5}{6 \times 2} = \frac{10}{12}$ Therefore $\frac{5}{6} = \frac{10}{12}$

3. Guide students through this example that asks them to write $\frac{4}{5}$, $\frac{9}{10}$ and $\frac{5}{6}$ as equivalent fractions with the same denominators.

4. Tell the students that the program they are about to use will teach them to write three fractions with the same denominators (LCD).

5. When the "Fractions Basic Skills" Disk is booted a menu appears. Students should select LESSON, SKILL 12 and EXERCISE 2. After completing EXERCISE 2, student should complete EXERCISE 3.

6. If a student misses 2 examples in a row, an automatic help lesson is performed.

7. After completing SKILLS 8-12, students can complete REVIEW 3.

Summary:

1. How do we determine the LCD of the denominators of three fractions?
2. How do write the fractions as equivalent fractions in higher terms with the same denominators (LCD).

Homework: See attached worksheet

Enrichment:

Write these fractions as equivalent fractions with the same denominators (LCD):

$\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{5}{9}$ and $\frac{1}{2}$

HOMEWORK ASSIGNMENT

In each example, change the fractions into equivalent fractions with the Least Common Denominator (LCD):

1\.
1/2 = ________
2/3 = ________
5/6 = ________

2\.
2/3 = ________
3/4 = ________
7/12 = ________

3\.
1/3 = ________
1/4 = ________
5/12 = ________

4\.
1/4 = ________
5/6 = ________
5/8 = ________

5\.
2/5 = ________
1/6 = ________
7/10 = ________

6\.
5/6 = ________
7/10 = ________
11/15 = ________

7\.
8/15 = ________
9/20 = ________
13/30 = ________

8\.
11/12 = ________
5/18 = ________
5/9 = ________

9\.
3/8 = ________
17/24 = ________
25/36 = ________

10\.
23/24 = ________
31/36 = ________
5/48 = ________

TOPIC 59: Subtracting Fractions and Mixed Numbers With Like Denominators

Aim: How do we subtract mixed numbers with like denominators with regrouping?

Performance Objectives: Students will be able to:

- solve problems involving the subtraction of mixed numbers with like denominators with regrouping
- state the procedure for subtracting mixed numbers with like denominators

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System by D.C. Heath Fractions Disk Part 2

Motivation:

In a 3 4/8 mile relay race, the first three runners ran a total of 2 5/8 miles. How far must the fourth and final runner go to finish the race?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.
   Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we must find the difference of the two distances.

$$\begin{array}{r} 4\,\frac{4}{8} \\ -\ 3\,\frac{5}{8} \\ \hline \end{array}$$

   Elicit from the class that this problem involves regrouping since we are unable to subtract $\frac{5}{8}$ from $\frac{4}{8}$ and get a positive answer.
   Show the class the following:

$$\begin{aligned} 4\,\tfrac{4}{8} &= 4 + \tfrac{4}{8} \\ &\ 3 + 1 + \tfrac{4}{8} \\ &\ 3 + \tfrac{8}{8} + \tfrac{4}{8} \\ &\ 3 + \tfrac{12}{8} \\ &\ 3\,\tfrac{12}{8} \end{aligned}$$

Explain to the class that this is called regrouping. Substitute the equivalent value for $4\frac{4}{8}$ into the problem and subtract.

$$\begin{array}{rcr} 4\frac{4}{8} & = & 3\frac{12}{8} \\ -\;3\frac{5}{8} & = & 3\frac{5}{8} \\ \hline & & \frac{7}{8} \end{array}$$

3. Repeat the process for the following and elicit the steps from the students. (See 2.)

$$\begin{array}{r} 7\frac{2}{9} \\ -\;3\frac{6}{9} \\ \hline \end{array}$$

4. Do the following:

$$\begin{array}{r} 7\frac{3}{8} \\ -\;2\frac{5}{8} \\ \hline \end{array} \qquad \begin{array}{r} 23\frac{3}{7} \\ -\;17\frac{6}{7} \\ \hline \end{array}$$

The teacher should remind the students to simplify their answers.

5. Before the class uses the computers review the procedures for handling the equipment.

Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T simultaneously. Type 2 the ENTER for the lesson number.

6. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different.

After the first and second round of questions, the students will reach the screen that tells how well they performed. When the students see the prompt they should type N; ENTER.

7. The student will then be shown an example of Subtraction of Mixed Numbers requiring regrouping. Four problems are given.
NOTE: a) If a mistake is made before the ENTER key is pressed, use the BACKSPACE key to erase.
b) When the students enter their answers, they should enter the whole number, and then the simplified proper fraction. If they do not enter it in this way, it will be counted as a mistake.

If the student makes a mistake, a tutorial screen will appear and review the procedure for subtraction, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

When the screen appears showing the number of correct out of 4, you may either have them do more problems by typing Y and ENTER or have students enter N, and the program will continue. Next to appear will be the accuracy check. At the end of the accuracy check, the students will be told whether they have achieved mastery of the skills, or should repeat the lesson.

9. Allow about 15-20 minutes to complete the computer-directed activity.

At the end of the session, have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. How would we do $6\frac{1}{3} - 3\frac{2}{3}$?
2. How do we subtract mixed numbers with like denominators with regrouping?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Consider the following sequences:

$\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, ...

15, $13\frac{3}{4}$, $12\frac{2}{4}$, $11\frac{1}{4}$, ...

4, $4\frac{1}{4}$, $3\frac{3}{4}$, 4, $3\frac{2}{4}$, ...

What would be the next three numbers for each sequence?

Solutions:

$2\frac{1}{2}$, 3, $3\frac{1}{2}$ (add $\frac{1}{2}$ to the last term to create the next term)

10, $8\frac{3}{4}$, $7\frac{2}{4}$ (subtract $1\frac{1}{4}$ from the last term to create the next term)

$3\frac{3}{4}$, $3\frac{1}{4}$, $3\frac{2}{4}$ (alternately add $\frac{1}{4}$ then subtract $\frac{2}{4}$ from the last term to create the next two terms)

TOPIC 60: Subtracting Fractions and Mixed Numbers With Unlike Denominators

Aim: How do we subtract fractions and mixed numbers with unlike denominators?

Performance Objectives: Students will be able to:

- subtract fractions with unlike denominators
- subtract mixed numbers with unlike denominators without regrouping
- subtract mixed numbers with unlike denominators with regrouping
- state the procedures for subtracting fractions and mixed numbers with unlike denominators

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with BASICA
- software: Elementary Mathematics Classroom Learning System by D.C. Heath Fraction Disk Part 2

Motivation:

Frank has a piece of wire that is 3/4 of a yard long. If he cuts 1/6 of a yard from it for hanging a picture, how much wire does he have left?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.
   Follow the screen instructions for putting management information on lesson disks.

2. Elicit that the motivation problem requires finding the difference between the original length of the wire and the length used for hanging the picture.

   $$\frac{3}{4} - \frac{1}{6}$$

   Elicit from the class that we must first find the common denominator for the two fractions and then rename them in equivalent form using the common denominator.
   If needed the teacher should review finding the least common denominator.

   PROBLEM LCD = 12

   $$\begin{array}{rcr} \frac{3}{4} & \frac{3}{4} \times \frac{3}{3} & \frac{9}{12} \\ \underline{-\ \frac{1}{6}} & \frac{1}{6} \times \frac{2}{2} & -\ \frac{2}{12} \\ \cline{3-3} & & \frac{7}{12} \end{array}$$

3. Have the class do the following:

$$\begin{array}{r} \frac{5}{6} \\ -\ \frac{5}{9} \\ \hline \end{array} \qquad \begin{array}{r} \frac{2}{3} \\ -\ \frac{3}{5} \\ \hline \end{array} \qquad \begin{array}{r} \frac{9}{10} \\ -\ \frac{3}{4} \\ \hline \end{array}$$

Remind the students to simplify their answers.

4. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)
   The next screen says: "You are now ready to begin your placement check."
   DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 4 then ENTER for the lesson number.

5. The student is shown an example of Subtraction of Fractions with Unlike Denominators following the method described in this lesson.

   During the six-problem drill, when prompted, "Enter the difference as a fraction in simplest form", the student should enter the numerator, slash (/), and the denominator. If a mistake is made before the ENTER key is pressed, use the BACKSPACE key to erase.

   If a mistake is made during the six-problem drill, a tutorial screen will appear and form the appropriate equivalent fractions with the LCD. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

   When the screen appears showing the number of correct out of 6, you can check the group's progress. After you clarify any misunderstandings you may have them do more problems by typing Y and Enter.

6. If no further practice is desired have the students leave the computer at this point, but do not let them quit the program.

7. Ask the class how would we find the answer to the following problem:

$$\begin{array}{r} 6\,\frac{3}{4} \\ -\quad 3\,\frac{1}{3} \\ \hline \end{array}$$

   Elicit from them that we first must rewrite the fractional part of the mixed numbers into equivalent fraction forms using their common denominator.

PROBLEM LCD = 12

$$\begin{array}{r} 6\,\frac{3}{4} \\ -\ 3\,\frac{1}{3} \\ \hline \end{array} \qquad \begin{array}{l} \frac{3}{4} \times \frac{3}{3} = \frac{9}{12} \\ \frac{1}{3} \times \frac{4}{4} = \frac{4}{12} \end{array} \qquad \begin{array}{r} 6\,\frac{9}{12} \\ -\ 3\,\frac{4}{12} \\ \hline 3\,\frac{5}{12} \end{array}$$

8. Have the students do the following:

$$\begin{array}{r} 7\,\frac{2}{3} \\ -\ 2\,\frac{1}{6} \\ \hline \end{array} \qquad \begin{array}{r} 5\,\frac{3}{4} \\ -\ 3\,\frac{2}{3} \\ \hline \end{array}$$

9. Next, have the students do the following the problem.

$$\begin{array}{r} 4\,\frac{1}{6} \\ -\ 1\,\frac{5}{8} \\ \hline \end{array}$$

Elicit the steps used in doing the problem.
PROBLEM LCD = 24

$$\begin{array}{r} 4\,\frac{1}{6} \\ -\ 1\,\frac{5}{8} \\ \hline \end{array} \qquad \begin{array}{l} \frac{1}{6} \times \frac{4}{4} = \frac{4}{24} \\ \frac{5}{8} \times \frac{3}{3} = \frac{15}{24} \end{array} \qquad \begin{array}{r} 4\,\frac{4}{24} \\ -\ 1\,\frac{15}{24} \\ \hline \end{array}$$

Elicit that to solve the problem the next step is to regroup.

$$\begin{aligned} 4\,\frac{4}{24} &= 4 + \frac{4}{24} \\ &= 3 + 1 + \frac{4}{24} \\ &= 3 + \frac{24}{24} + \frac{4}{24} \\ &= 3\,\frac{28}{24} \end{aligned}$$

Rewrite the problem and find the answer.

$$\begin{array}{r} 4\,\frac{1}{6} \\ -\ 1\,\frac{3}{4} \\ \hline \end{array} \qquad \begin{array}{r} 4\,\frac{4}{24} \\ -\ 1\,\frac{15}{24} \\ \hline \end{array} \qquad \begin{array}{r} 3\,\frac{28}{24} \\ -\ 1\,\frac{15}{24} \\ \hline 2\,\frac{13}{24} \end{array}$$

10. Have the students return to computer-centered instruction.

11. Two examples of Subtraction of Mixed Numbers with Unlike Denominators will be given. Six questions will then be given on mixed number subtraction. When the students enter their answers, they should enter the whole number, and then the simplified proper fraction. If they do not enter it this way it will be counted as a mistake. If the student makes a mistake, a tutorial screen will appear and review the procedure for converting and subtraction, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

When the screen appears showing the number of correct out of 6, you can check the group's progress. You may have them do more problems by typing Y; ENTER or N and the program will continue.

13. Next to appear will be the accuracy check. If the student passes this first part, the accuracy check continues with Subtraction of Mixed Numbers with Unlike Denominators. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they have to repeat it.

14. Students should be given approximately 20-25 minutes to complete the computer-directed activity.

    At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

__Summary:__

1. When is it necessary to rename a mixed number in a subtraction example?
2. When is it necessary to regroup in a subtraction example?

__Homework:__

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

__Enrichment:__

Consider the following sequence:

$10, 8\frac{3}{4}, 7\frac{1}{2}, \ldots$

What would be the next three numbers in the sequence?

TOPIC 61: Renaming a Mixed Number Using a Whole Number That Is One Less Than the Given Whole Number

Aim: How do we rename a mixed number using a whole number that is one less than the given whole number?

Performance Objectives: Students will be able to:

- identify the whole number portion of a mixed number
- decrease the whole number portion of a mixed number by one
- adjust the fractional portion so that the values remain equivalent
- rename a mixed number using a whole number that is one less than the given whole number

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor (management system requires 80 column card)
- software: Houghton Mifflin Computational Skills Program: Fractions Basic Skills Disk

Motivation:

John had \$3 $\frac{3}{4}$. How many quarters must he give his friend Bob so that he would have \$2 left?

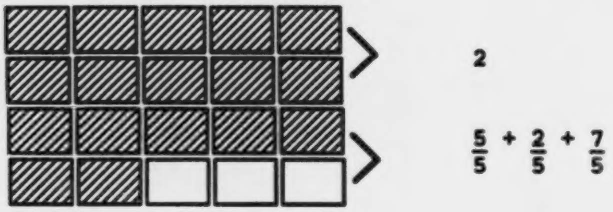
Development:

1. Elicit a solution to the Motivation.
   $\$3\frac{3}{4} = 2 + \boxed{}(1\frac{3}{4})$ $1\frac{3}{4} = \frac{7}{4}$ Therefore, John gave Bill $\frac{7}{4}$

2. Explain to students that this procedure will help them when they study difficult subtraction or mixed numbers or whole numbers examples.

   Display this diagram on the chalkboard:

   $3\frac{2}{5} = 2\frac{\boxed{}}{5}$



$3\frac{2}{5} = 2\frac{7}{5}$

or $3\frac{2}{5} = 2 + 1 + \frac{2}{5} = 2 + \frac{5}{5} + \frac{2}{5} = 2 + \frac{7}{5} = 2\frac{7}{5}$

$3\frac{2}{5} = 2\frac{7}{5}$

3. Guide the students through the above procedure:
   a) Which is the whole number portion of $3\frac{2}{5}$? (3)
   b) What is one less than that whole number? (2)
   c) Notice that $\frac{5}{5}$ is left as well as $\frac{2}{5}$
   d) $\frac{5}{5} + \frac{2}{5} = \frac{7}{5}$
   e) Therefore, $3\frac{2}{5} = 2\frac{7}{5}$

4. Guide the students through the following practice examples:

   a) $6\frac{2}{3} = 5\frac{\qquad}{3}$
   b) $9\frac{3}{4} = 8\frac{\qquad}{4}$
   c) $4\frac{1}{2} = 3\frac{\qquad}{2}$
   d) $8\frac{5}{6} =$
   e) $23\frac{5}{9} =$

5. Tell the students that the program they are about to use will teach them how to rename a mixed number using a whole number that is one less than the given number.

6. When the "Fractions Basic Skills" disk is booted a menu appears. Students should select LESSON, SKILL 15 and EXERCISE 1. After completing EXERCISE 1, students should complete EXERCISE 2 and EXERCISE 3.

7. If a student misses two examples in a row, an automatic help lesson is performed.

8. After completing SKILLS 13-15, the student can complete REVIEW 4.

Summary:

1. Which is the whole number portion of a mixed number?
2. How do we decrease the whole number portion of a mixed number by one?
3. How do we adjust the fractional portion so that the values remain equivalent?
4. How do we rename a mixed number using a whole number that is one less than the given whole number?

Homework: See attached worksheet

Enrichment:

Rename the following mixed numbers using a whole number that is one less than the given whole number.

a) $30\frac{1}{4}$ b) $150\frac{3}{7}$ c) 200 d) $1000\frac{7}{8}$

Homework Assignment

Rename these mixed numbers using a whole number that is one less than the given number:

1. $7\frac{2}{3} = 6\frac{\boxed{}}{3}$
2. $5\frac{1}{8} = 4\frac{\boxed{}}{8}$
3. $9\frac{1}{2} = 8\frac{\boxed{}}{2}$
4. $17\frac{1}{3} = 16\frac{\boxed{}}{3}$
5. $3\frac{3}{5} = 2\frac{\boxed{}}{5}$
6. $7\frac{5}{6} = 6\frac{\boxed{}}{6}$
7. $9\frac{1}{10} = 8\frac{\boxed{}}{10}$
8. $3\frac{7}{8} = 2\frac{\boxed{}}{8}$
9. $5\frac{5}{7} = 4\frac{\boxed{}}{7}$
10. $14\frac{3}{10} = 13\frac{\boxed{}}{10}$
11. $3\frac{4}{9} =$
12. $7\frac{3}{4} =$
13. $5\frac{5}{10} =$
14. $11\frac{7}{10} =$
15. $8\frac{2}{13} =$
16. $28\frac{2}{7} =$
17. $12\frac{3}{8} =$
18. $9\frac{3}{16} =$
19. $3\frac{4}{11} =$
20. $13\frac{7}{25} =$

TOPIC 62: Introduction to Rational Numbers in Fraction Form

Aim: What is fraction form?

Performance Objectives: Students will be able to:

- write a ratio as a fraction
- identify fraction form

Vocabulary:

Ratio, fraction, set

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath
- worksheet for homework

Motivation:

There are 30 students in our class. Yesterday, only 25 of them handed in their homework. How would you represent the relationship between the number of students who handed in their homework, and the total number of students in the class?

Development:

1. Preparing the software for classroom use: the following setup will have to be done only once. Place the management disk in drive A, when the main menu appears, select option 1, type A and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For STUDENT NAMES, type A for FIRST NAME; ENTER and A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each. Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that this is a ratio problem and the ratio is 25 out of 30. Ask if there is another way of writing this ratio (25/30) [fraction form]

3. Jane made 7 quarts of green paint by mixing 3 quarts of yellow paint with 4 quarts of blue paint. What part of the green paint was originally yellow? Elicit the ratio 3/7.

   Bill cuts a cake into 8 equal pieces. He than eats 2 pieces. What is the ratio of the pieces eaten to the cake in fraction form?

   Elicit from the class that a ratio is a comparison of a part(s) to a whole (or group).

4. Before the class uses the computers review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T simultaneously. Type 1 then ENTER for the lesson number.

5. The class will be shown a set of letters and told that there is a certain number of one particular kind in the set. They will also see that there is a total number of letters in the set. This ratio will then be represented in fractional from. The student will then be asked to follow the procedure and to type in the fractional form for the next set of letters that appear. (Note: In order to write the answer, the students should type the digit for the top number, numerator, then the slash [/] and then the bottom number, denominator, then ENTER.)

   Six questions will be given in this form. If the student makes a mistake, a tutorial screen will remind the student of the key elements of the ratio and ask the student to try again. If the student makes the mistake again, the screen will explain the solution and give the answer, then go on to the next problem.

   After the sixth problem, the student is told how well he/she performed. At this point the screen asks whether the student would like more practice in this objective. If time permits, have the student type "Y" and then ENTER.

6. Allow about 10-15 minutes to complete the computer-directed activity.

   At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. Identify which of the following are in fraction form:
   a) $\frac{3}{4}$ b) $\frac{8}{3}$ c) 9 d) 0

2. The Tigers, a Little League Baseball team, played 22 games this season. They won 17 of their games. What fractional part of their games did they win?

3. Below is a scoreboard from one of their games. Use a fraction to represent the number of innings in which the Tigers scored to the total number of innings.

Innings	1	2	3	4	5	6	7
Tigers	3	1	0	1	2	4	0

Homework:

See attached worksheet.
In addition to the worksheet the teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Riddle: A set of letters is made up of the following ratios - 2/8 of the letters are b's, 2/8 of the letters are a's, 2/8 of the letters are l's, 1/8 of the letters is an s, and 1/8 of the letters is an e. Write the letters down and then unscramble them.

HOMEWORK ASSIGNMENT

I. How many elements in all are there in each of the sets below?

[A C A D A A]   [@ # $ # # @ %]

II. [L L M P L R P L M P P R]

Using the set of letters above:

Tell how many of the letters are:	What fractional part of the set of letters are
L's _______________	L's ______________
M's _______________	M's _______________
P's _______________	P's _______________
R's ______________	R's _______________

III. Circle which of the following are in fraction form:

a. $\frac{17}{22}$ b. 3   c. 1   d. $\frac{4}{5}$ e. $\frac{6}{8}$

IV.

1. Mary went to the refrigerator to get some fruit. If there were 7 apples in the refrigerator, and Mary takes 4 of them, how would you represent the relationship between what Mary takes and the original number of apples?

2. Mary passed by the oven and saw that there were 12 muffins in a pan. 7 of the muffins were blueberry.

What fraction were blueberry? ____________

What were not blueberry? ______________

3. Seven children went to the candy store and bought gum. Eight more children went to the store to buy soda. What fractional part of the children bought gum?

What fractional part of the children bought soda?

4. Our mathematics class has 30 students. There are 12 boys and 18 girls. Nine of the boys are wearing sneakers and 9 of the girls are wearing sneakers.

   Write a fraction to represent the following ratios:

   a. Number of boys wearing sneakers to all the boys. ______

   b. Number of boys wearing sneakers to the whole class. ______

   c. Number of girls wearing sneakers to all girls. _______

   d. Number of girls wearing sneakers to the whole class. _______

   e. Number of children wearing sneakers to the whole class. _______

TOPIC 63: Illustrating Rational Numbers in Fraction Form

Aim: How do we represent fractions with shaded rods and on a number line?

Performance Objectives: Students will be able to:

- shade in a section of a rod to represent a given fraction
- mark off a number line to represent a given fraction
- identify the numerator and denominator of a fraction
- recognize the fraction forms of numbers equal to one

Vocabulary:

shaded rods, numerator, denominator, number line

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals) by D.C. Heath
- worksheet for homework

Motivation:

Carl went home for lunch and ate 3/4 of a Sicilian pizza. Richard went to a restaurant and ate 1/4 from each of the two Sicilian pizzas his parents ordered. Who ate more? [All pies were the same size.]

Development:

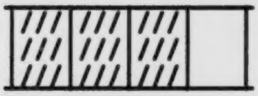
1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.

   Follow the screen instructions for putting management information on lesson disks.

2. Have the students represent how much pizza pie Carl ate as follows: Elicit that the pie must be divided into 4 equal portions [illustrate].

   Elicit that the 3 of the 4 equal potions must be shaded [illustrate].

3. Review with the class the names for the parts of the fraction:

   3 --> numerator
   4 --> denominator

4. Review the meaning of numerator and denominator.
    a) Elicit that the denominator represents the number of the set or the parts the unit is divided into.
    b) Elicit that the numerator represents the number of objects chosen or the parts of the unit chosen.

5. Before the class uses the computers review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
        (You may choose a different password.)
   The next screen says: "You are now ready to begin your placement check."
   DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 1 then ENTER for the lesson number.

6. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different.

   After the first round of 6 questions, a score is given. When the students see a prompt, they should type N; ENTER.

7. The students will see a rod divided into parts, some of which are shaded. The students will read what fractional part is shaded.

   Six questions will then be given in this form. If a student makes a mistake, a tutorial screen will display the key elements of the ratio and ask the student to try again. If the student makes the mistake again, the screen will explain the solution and give the answer, then go on to the next problem.

   After six questions a score is given. Students may then do more problems by typing Y and ENTER.

8. Allow the students about 10-15 minutes to complete the computer-directed activity.

9. Elicit from the students how to represent the fraction 4/4. Have the students illustrate their answers by shading a rod (entire unit is shaded).

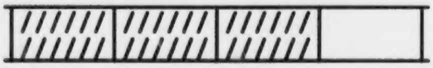
   Elicit that the value of 4/4 is equal to 1.

   Show the students diagrams of shade rods illustrating $\frac{6}{6} = 1$, $\frac{8}{8} = 1$, etc.

10. Elicit a generalization from the students that any fraction in which the numerator and the denominator are the same equals one [except when both are zero].

11. Elicit from the students what a number line is. Elicit how we represent numbers on a number line? Explain that the location of a fraction on a number line is found by a method similar to representing a fraction by shading in a rod.

```
e.g. 3     <----|------|------|------*------|--->
     4          0                   3/4     1
```



12. Have the students return to the computers and go to the next part of the lesson by pressing N and ENTER. A number line will appear on the screen and be divided into 3 parts, and then the names of the parts will be illustrated by using an arrow.

13. Six questions will be given in this form. If the student makes a mistake, a tutorial screen will remind the student of the key elements of the ratio and ask the student to try again. If the student makes the mistake again, the screen will explain the solution and give the answer, then go on to the next problem.

    When the screen appears showing the number of correct out of 6, you may either have them do more problems by typing Y and ENTER; or have them enter N and the program will continue. Next to appear will be the accuracy check. Similarly, the student may progress onto the final test. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or should repeat it.

14. Allow about 10-15 minutes to complete the computer-directed activity.

    At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

<u>Summary</u>:

1. Make a drawing representing 3/4.
2. What name do we give to the '3' in the fraction 3/7?
3. What name do we give to the '7' in the fraction 3/7?
4. Name three fractions that are equal to 1.
5. On a number line represent 5/8.

<u>Homework</u>:

See attached worksheet
In addition to the worksheet the teacher should include problems on earlier work so that the homework assignment is spiraled.

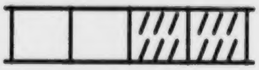
<u>Enrichment</u>:

How would you represent the following problem? A mother gives 1/2 of a bag of candy to her youngest daughter. She then gives 1/2 of the remainder to her youngest son. She then gives 1/2 of what was left to her husband. What did she have left for herself?

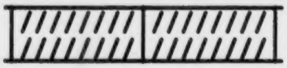
HOMEWORK ASSIGNMENT

1. Write the name of the fraction which is represented by the following shaded rods.

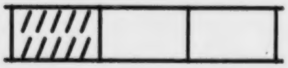
a)



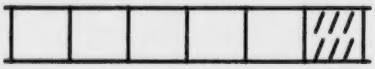
b)



c)

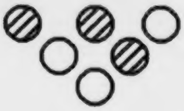


d)

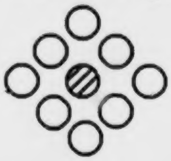


2. Write a fraction which indicates the ratio of part of the set to the whole set.

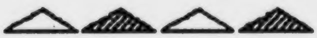
a)



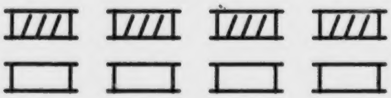
b)



c)

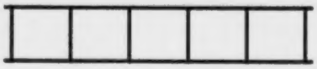


d)

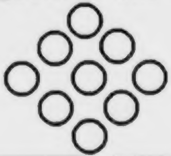


3. Shade in the part of each picture to represent the fraction indicated.

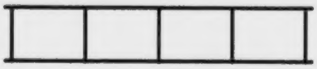
a) $\frac{3}{5}$



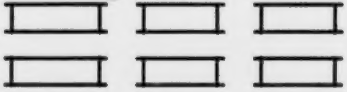
b) $\frac{4}{9}$



c) $\frac{4}{4}$



d) $\frac{5}{6}$



4. Write the name of the fraction which is represented on the number line.

a)

```
<--|---|---|---*---|-->
   0               1
```

$\frac{\square}{\square}$

b)

```
<-|--|--*--|--|--|->
  0              1
```

$\frac{\square}{\square}$

c)

```
<-|--|--|--|--|--|--*--|--|->
  0                      1
```

$\frac{\square}{\square}$

d)

```
<-|--|--*--|--|--|--|->
  0                 1
```

$\frac{\square}{\square}$

5. Write the ratio (fraction form) suggested by the sentence for the following:
   a) May finished 18 problems out of 20 on her test.
   b) Pedro won three out of five chess games he played.

6. **HARD PROBLEM:**
   Which is greater: 4/9 or 5/7?
   [Hint: Use shaded rods to find the answer.]

TOPIC 64: Multiplying Fractions

Aim: How do we compute the product of two fractions?

Performance Objectives: Students will be able to:

- state the algorithm for multiplication of fractions
- apply the algorithm for multiplication of fractions

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Fractions Part 3) by D.C. Heath

Motivation:

Clifford brought a pizza home. Since he wasn't very hungry, he ate only 1/3 of it for lunch. Later he ate 1/2 of what was left, for a snack. What part of the whole pie did Clifford eat for a snack?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

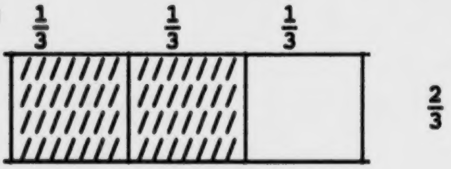
   Place the management disk in drive A. When the main menu appears, select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.

   Follow the screen instructions for putting management information on lesson disks.

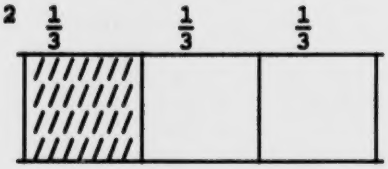
2. Illustrate that after eating 1/3 of the pie, 2/3 remain.

3. Elicit from the class that the problem requires that they find $\frac{1}{2}$ of $\frac{2}{3}$ of the pizza.

   Illustrate:



   Find 1 of 2



   $\frac{1}{2}$ of $\frac{2}{3}$ = $\frac{1}{3}$

   Elicit that the product of $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$

4. Lead the students to the generalization that the product of two fractions is equal to a fraction whose numerator is the product of the numerators of the given fractions and whose denominator is the product of the given fractions.

$$\frac{1}{2} \times \frac{2}{3} = \frac{1 \times 2}{2 \times 3} = \frac{2}{6}$$

In simplest form $\frac{2}{6} = \frac{1}{3}$

Demonstrate the algorithm for further practice:

$$\frac{3}{5} \times \frac{4}{9} = \frac{3 \times 4}{5 \times 9} = \frac{12}{45}$$

Remind the students to simplify the answer.

$$\frac{12}{45} = \frac{4}{15}$$

5. Before the class uses the computers, review the procedures for handling the equipment.

Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears, have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check."
DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 1 then ENTER for the lesson number.

6. The student is shown two examples demonstrating the concept of Multiplication of Fractions using shaded rods, as displayed in #3. This explanation is followed by an eight problem drill. If a mistake is made before the ENTER key is pressed, use the BACKSPACE key to erase.

If the student makes a mistake, a tutorial screen will appear and review the procedure for multiplication, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

When the screen appears showing the number of correct out of 8, you can check the group's progress. After you clarify any misunderstandings, you may have them do more problems by typing Y and ENTER to continue the drill cycle.

7. If the student enters N, the program will move on to the accuracy check. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they should repeat it.

8. Allow about 20-25 minutes to complete the computer-directed activity. At the end of the session have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. Have the students state the procedure for multiplying fractions.
2. Have them explain why $8 \times \frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}$.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Our class wants to have a pizza party. There are 30 students and each wants 2 slices, so we need 10 pies with 6 slices in each pie. 1/2 of the students want their slices plain. 2/3 of the remaining students want sausage on their slices, and of those, 3/5 want onions as well. 1/2 of this last group also want peppers. How many of the students want sausage, onions and peppers on their slices? Would you be brave enough to go to the store and order this?

TOPIC 65: Multiplying Mixed Numbers

Aim: How do we compute the product of mixed numbers?

Performance Objectives: Students will be able to:

- apply the algorithm for multiplication of fractions to multiplying mixed numbers
- state the procedure for multiplying mixed numbers

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Fractions Part 3) by D.C. Heath

Motivation:

Maria takes the subway to school every day. If she takes the local, it takes her-1 1/4 hours. If she takes the express, it takes her only 2/3 as long. How long does the travel take on the express?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.

   Follow the screen instructions for putting management information on lesson disks.

2. Elicit that the motivation can be solved by finding the product of $\frac{2}{3} \times 1\frac{1}{4}$

   Elicit that we must first rewrite $1\frac{1}{4}$ as an improper fraction.

   $$1\frac{1}{4} = \frac{(4 \times 1) + 1}{4} = \frac{5}{4}$$

   Substitute $\frac{5}{4}$ for $1\frac{1}{4}$.

   $$\frac{2}{3} \times 1\frac{1}{4}$$

   $$\frac{2}{3} \times \frac{5}{4} = \frac{2 \times 5}{3 \times 4} = \frac{10}{12}$$

   Remind the class to simplify the answer. $\frac{10}{12} = \frac{5}{6}$

3. Have the class do the following using the same procedure as #2:

$\frac{4}{5} \times 2\frac{2}{3}$	$3\frac{1}{2} \times 2\frac{2}{3}$
$\frac{4}{5} \times \frac{8}{3} =$	$\frac{7}{2} \times \frac{8}{3} =$
$\frac{32}{15} = 2\frac{2}{15}$	$\frac{56}{6} = 9\frac{2}{6} = 9\frac{1}{3}$

4. Elicit the procedures for multiplying mixed numbers.
   a) First change the mixed numbers into improper fractions.
   b) Multiply the fractions.
   c) Simplify the product.

5. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears, have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)
   The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 2 then ENTER for the lesson number.

6. The student will be shown 2 examples demonstrating the procedure for multiplication as described in #4 above. This is followed by a six-problem drill. For simplest form, the student should enter the whole number, the numerator, slash (/), and the denominator. Otherwise, it is counted as a mistake. If a mistake is made before ENTER is pressed, use the BACKSPACE key to erase.

   If a mistake is made during the six problem drill, a tutorial screen will appear, converting the factors to improper fraction form, ready to be multiplied. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

   When the screen appears showing the number of correct out of 6, you may either have them do more problems by typing Y and ENTER, or have student enter N, and the program will continue. Next to appear will be the accuracy check. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or should repeat it.

9. Allow students about 10-15 minutes to complete the computer-directed activity. At the end of the session, have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. Have the students find the product of

$$4\frac{2}{5} \times 5\frac{3}{11}$$

2. Have the students state the procedures for multiplying two mixed numbers.

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

To win an election, Wing needs 3/4 of the votes cast. If after 2/3 of the votes are counted, Wing has 5/6 of what he needs, what part of the remaining votes must he receive to win?

TOPIC 66: Dividing Fractions

Aim: How do we divide fractions?

Performance Objectives: Students will be able to:

- find the reciprocal of a given fraction
- divide fractions
- state the procedure for dividing fractions

Vocabulary: reciprocal

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Fractions Part 3) by D.C. Heath

Motivation:

What would be the quotient of $\frac{1}{6}$ divided by $\frac{1}{2}$?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1 and type "A" and press ENTER. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.

   Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that this is a division problem.

   $$\frac{1}{6} \div \frac{1}{2} = \underline{\qquad\qquad}$$

   Elicit that we could rewrite this problem as a multiplication problem just as we could rewrite the whole number problem 6 ÷ 2 = _____ as ____ x 2 = 6.

   $$\frac{1}{6} = \frac{\square}{\square} \times \frac{1}{2}$$

   $$\frac{1}{6} = \frac{1}{3} \times \frac{1}{2}$$

   Tell the class that there is another method that is easier.

3. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears, have the student press ENTER, and answer the questions on the screen as follows:

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 3 then ENTER for the lesson number.

4. The student is presented with a division problem, and asked how it could be solved. This explanation is followed by a four problem drill.
When the quotient is called for in simplest form, it must be entered as a fraction, even if the answer is an improper fraction. To do this, enter the numerator, slash (/), then denominator.
If a mistake is made before ENTER is pressed, use the BACKSPACE key to erase.

If the student makes a mistake, a tutorial screen will appear, illustrating the problem as a multiplication problem with a missing factor. Then the screen will return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

The students will leave the computer lesson at this point and return to teacher-centered activities.

5. Review with the class the meaning of reciprocal.

What do the following products equal?:

a) $\frac{1}{2} \times \frac{2}{1}$ b) $\frac{2}{3} \times \frac{3}{2}$

c) $\frac{5}{6} \times \frac{6}{5}$ d) $\frac{8}{3} \times \frac{3}{8}$

What is the reciprocal of $\frac{1}{2}$? Elicit that the reciprocal of $\frac{1}{2}$ is $\frac{2}{1}$ or 2.

What is the reciprocal of $\frac{2}{3}$? $\frac{5}{6}$? $\frac{8}{3}$? ($\frac{3}{2}$, $\frac{6}{5}$, $\frac{3}{8}$,)
Elicit from the class a method for finding the reciprocal. (Interchange the numerator and denominator of the original fraction.)

6. Review with the class the algorithm for dividing fractions
$\frac{2}{3} \div \frac{2}{5} =$
Find the reciprocal of the divisor $\frac{2}{5}$; $\frac{5}{2}$. Rewrite the division problem as a multiplication problem.
$\frac{2}{3} \times \frac{5}{2} = \frac{10}{6} = \frac{5}{3} = 1\frac{2}{3}$

7. Have the students do the following, using the steps in #6:
$\frac{4}{5} \div \frac{2}{3}$ $8 \div \frac{4}{5}$

8. Elicit from the students the procedure for dividing fractions.
   a) Find the reciprocal for the divisor.
   b) Rewrite the division problem as a multiplication problem using the reciprocal.

9. Have the students return to the computers and enter N. The program will continue with two more division problems. This will be followed by a five problem drill.

   If the student makes a mistake during the drill, a tutorial screen will appear and review the procedure for division, then return to the problem. If a mistake is made again, the procedure will be shown, and the problem solved.

   When the screen appears showing the number of correct out of 5, you may either have them do more problems by typing Y and ENTER, or have students enter N, and the program will continue. Next to appear will be the accuracy check. At the end of this sequence, the student is told whether he or she has achieved mastery of the lesson or should repeat it.

10. Allow about 15-20 minutes to complete the computer-directed activity.

   At the end of the session, have students remove the disks from the machines, and turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. What is the reciprocal of 3/4?
2. What is the quotient of 5/6 divided by 1/2?
3. What is the procedure for dividing fractions?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Which of the following fractions is greater than $\frac{1}{3}$ but less than $\frac{1}{2}$. [Explain your answer.]

a) $\frac{10}{32}$ b) $\frac{7}{13}$ c) $\frac{4}{15}$ d) $\frac{6}{17}$ e) $\frac{13}{25}$

TOPIC 67: Dividing Mixed Numbers

Aim: How do we divide mixed numbers?

Performance Objectives: Students will be able to:

- find the reciprocal of a given mixed number
- divide a mixed number by a fraction
- divide a mixed number by a mixed number
- state the procedure for dividing mixed numbers

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Fractions Part 3) by D.C. Heath

Motivation:

What is the quotient of $2\frac{1}{2}$ divided by $\frac{5}{7}$?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1 and type "A" and press ENTER. When you are asked to type group name, use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For student names, type A for FIRST NAME; ENTER; A for LAST NAME; ENTER. For the last three prompts, type N and ENTER for each.

   Follow the screen instructions for putting management information on lesson disks.

2. Elicit from the class that we must rewrite the mixed number as an improper fraction, then rewrite the division problem as a multiplication problem.

$$2\frac{1}{2} \div \frac{5}{7} =$$

$$\frac{5}{2} \div \frac{5}{7} =$$

$$\frac{5}{2} \times \frac{7}{5} = \frac{35}{10} = 3\frac{5}{20} = 3\frac{1}{2}$$

3. What would be the quotient of $\frac{5}{6} \div 3\frac{1}{4}$?

   Elicit that we need to find the reciprocal of $3\frac{1}{4}$.

   We must rewrite it as an improper fraction first.

   $3\frac{1}{4} = \frac{13}{4}$

   Find the reciprocal of $\frac{13}{4}$: $\frac{4}{13}$

The next step would be to rewrite the division problem as a multiplication problem.

$$\frac{5}{6} \div \frac{13}{4} =$$

$$\frac{5}{6} \times \frac{4}{13} = \frac{20}{78} = \frac{10}{39}$$

4. Do the following, using the steps in #3: $2\frac{1}{10} \div 1\frac{3}{4}$

5. Elicit the procedure for finding the reciprocal of a mixed number.
    a) Rewrite the mixed number as an improper fraction.
    b) Find the reciprocal of the improper fraction.

6. Elicit the procedures for dividing mixed numbers.
    a) First rewrite the mixed numbers in the problem into improper fractions.
    b) Rewrite the division problem as a multiplication problem.
    c) Simplify the quotient.

7. Before the class uses the computers review the procedures for handling the equipment.

    Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears, have the student press ENTER, and answer the questions on the screen as follows:

    Type A for the first name; ENTER.
    Type MATH for the group name; ENTER.
    Type 1 for the student number; ENTER.
    Type A for the password; ENTER.
    Type A for the password again; ENTER.
    (You may choose a different password.)
    The next screen says: "You are now ready to begin your placement check."
    DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 4 then ENTER for the lesson number.

8. The student will be shown an example demonstrating the procedure for division of mixed numbers as described in #6 above. This is followed by an eight problem drill. The student should enter the whole number, the numerator, slash (/), and the denominator for simplest mixed number form. Otherwise it is counted as a mistake. If a mistake is made before ENTER is pressed, use the BACKSPACE key to erase.

    If a mistake is made during the drill, a tutorial screen will appear, converting the mixed numbers to improper fraction form, ready to be multiplied using the reciprocal of the divisor. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

    When the screen appears showing the number of correct out of 8, you may then do more of the same type of problems by typing Y and ENTER, or have the student enter N, and the program will continue. Next to appear will be the accuracy check. This part of the program is self-explanatory and works on the principle of 4 correct answers out of a possible 5. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they should repeat it.

9. Allow students about 20-25 minutes to complete the computer-directed activity. At the end of the session, have students remove the disks from the machines, turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. What is the reciprocal of $2\frac{3}{4}$?
2. What is the procedure for finding the reciprocal of a mixed number.
3. What is the quotient of $2\frac{1}{6}$ divided by $2\frac{1}{2}$?
4. What is the procedure for dividing mixed numbers.

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

$$\frac{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9}{6 \times 7 \times 8 \times 9} =$$

Note: The teacher should lead the students to realize that simply computing the answer causes them to manipulate large numbers. Therefore they should look for some method to reduce the amount of computation with large numbers.

TOPIC 68: Reducing Fractions to Simplest Form

Aim: How do we reduce fractions to simplest form?

Performance Objectives: Students will be able to:

- state the procedure for finding the simplest form of a fraction
- demonstrate increased accuracy and speed in reducing a fraction to simplest form

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Game Disk) by D.C. Heath

Motivation:

How do we reduce the fraction $\frac{18}{30}$ to simplest form?

Development:

1. Elicit from the class the procedure for finding an equivalent fraction. (Multiply the Numerator and Denominator by a fractional equivalent of 1)
   e.g. $\frac{3}{5} = \frac{3 \times 6}{5 \times 6} = \frac{?}{30}$
2. Elicit from the class the procedure for reducing a fraction to simplest form. (Divide the numerator and denominator by a fraction equivalent of 1)
3. Elicit from the class the answer to the motivation.
   e.g. $\frac{18}{30} = \frac{18 \quad 6}{30 \quad 6} = \frac{3}{5}$
4. Remind students that a fraction is in simplest form when 1 is the only common factor of the numerator and denominator. (Relatively prime)

   Ask the class, "What would be the simplest form of the following?"

   a. $\frac{8}{12}$ b. $\frac{10}{8}$ c. $\frac{5}{7}$ d. $\frac{24}{36}$
5. Explain that in the game the students will be playing, a fraction will be given which the students must reduce to simplest form.
6. No prior software set up is necessary. Have students insert disk, and press ENTER after welcome screen appears. After menu screen appears, type 2 and ENTER. Instructions concerning the game will appear on the screen. Press ENTER to begin.
7. Two students should work on the computer together: one to figure out the answer, the other to input the answer. Paper and pencil may be necessary for computation.
8. The students will be given ten questions and will receive from 1 to 5 points for each correct answer depending upon how quickly the answer is entered. A tutorial will come on if an incorrect answer is given, but the student will receive no points for that question. At the end of the

ten questions, the student's performance is rated on a thermometer type scale. Have the students press ENTER and the menu appears. The two students may switch positions, type 2, and begin again.

9. Students should be given 20-25 minutes to complete the computer-directed activity.

   At the end of the session, have students remove the disks from the machines, and turn off the computers, and put the diskettes into their protective covers carefully.

Summary:

1. Write three fractional equivalents for 1.
2. Can 6/8 be reduced? Why?
3. Can 5/8 be reduced? Why not?
4. What is meant by simplest form of a fraction?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Write mathematical expressions equal to 1, 2, 3, 4, and 5, using exactly four 5's.

Some possible solutions:

$$5 - 5 + \frac{5}{5} = 1 \qquad \frac{5}{5} + \frac{5}{5} = 2$$

$$\frac{5 + 5 + 5}{5} = 3 \qquad \frac{5 \times 5 - 5}{5} = 4$$

$$(5 - 5)5 + 5 = 5$$

PART VII

Decimals

TOPIC 69: Decimal Notation

Aim: How do we convert fractions and mixed numbers with base ten denominators to decimals and vice-versa?

Performance Objectives: Students will be able to:

- express fractions with denominators of 10, 100, 1000 in decimal form
- express mixed numbers whose fractional parts have denominators of 10, 100, 1000 in decimal form
- express decimals in expanded form

Vocabulary:

decimal, decimal fraction, tenths, hundredths, thousandths

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

A student divides 576 by 1000 on a calculator and the answer is 0.576. How does the answer relate to the fraction 576/1000?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A; turn on the computer and monitor. When the main menu appears select option 1, type A, and press ENTER. When asked to type group name, use MATH. This will be used for identification purposes later when the class signs on. When asked for number of students, type 1 and press ENTER. For student names, type A for first name and press ENTER, and type A for the last name and press ENTER. (Use A for convenience.)
   Roster review - type N and press ENTER
   Any changes - type "N" and press ENTER
   Another group - type "N" and press ENTER
   Follow the screen instructions for putting management information on lesson disks.

   If the teacher wants to use the Management System to keep track of individual students, the teacher should follow the instructions for set-up described in the manual which comes with the software.
   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit from the students that 576/1000 is equivalent to 0.576. 576/1000 is in fraction form and 0.576 is in decimal (fraction) form.

3. Review the place value table with the class.

1000	100	10	1			

Elicit from the class that the column to the left is always ten times greater than the one to the right.

1000 = 10 x 100
100 = 10 x 10
10 = 10 x 1

4. Review expanded form with whole numbers. Have the students write 678 in expanded form.

	1000	100	10	1
678 =		6	7	8

(6 x 100) + (7 x 10) + (8 x 1)

5. Elicit from the students how we might write 0.576 in expanded form by using the place value table.

	1	1/10	1/100	1/1000
.576 =		5	7	6

.576 = (5 x 1/10) + (7 x 1/100) + (6 x 1/1000)

6. Have the students write the following in expanded form.
   a) 0.459 b) 0.621

7. Ask the class what 7/10 equals as a decimal. Elicit that it equals 0.7 because the denominator is 10, thus the numerator 7 belongs under the tenths column of the place value table. (use table in #5)

	1	1/10	1/100	1/1000
$\frac{7}{10}$ = .7 =		7		

8. What would 3 4/10 equal as a decimal? Elicit that it equals 3.4 because the whole number 3 belongs under the ones column and the 3 belongs under the tenths column of the place value table.

	1	1/10	1/100	1/1000
$3\frac{4}{10}$ = 3.4 =	3	4		

= $3 + \frac{4}{10}$

9. Have the students write the following in decimal form.
   a) $8\frac{9}{10}$ b) $5\frac{1}{10}$

10. Before the class uses the computers review the procedures for handling the equipment.

    The students should insert the lesson disk carefully into drive A and turn on the computer and monitor. When the welcome screen appears have the students press ENTER and do the following:

    Type A for the first name; ENTER
    Type MATH for the group name; ENTER
    Type 1 for the student number; ENTER
    Type A for the password; ENTER
    Type A for the password again; ENTER
    (You may choose a different password.)

The next screen says: You are now ready to begin your placement check. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them press the Control and T keys simultaneously. They will then proceed to the next screen which will ask them to: "Type the number of the lesson you want." Have the class type "1", then press ENTER.

11. The student will be shown how to write a mixed number as a decimal. The proper placement of the digits in the decimal number is demonstrated.

    If a mistake is made during the drill, a tutorial screen will appear with a diagram of the placement of the digits. If the student makes the mistake again, the screen will demonstrate the correct answer, then go onto the next problem.

12. When the screen appears showing the number of correct out of 3, you can check the group's progress. Ask the students to raise their hands when they reach this point and walk over and check their results. After you clarify any misunderstandings, you may have them do more problems by typing "Y" and pressing ENTER.

    NOTE: The student may stay in this drill cycle as long as you prefer simply by entering "Y" each time this screen appears. The problems are randomized.

13. Next the students will see how two- and three-place decimals are named. This is followed by an eight problem drill.

    NOTE: The student may stay in this drill cycle as long as you prefer simply by entering "Y" each time this screen appears. The problems are randomized.

14. Allow students about 10-15 minutes to complete the computer-directed activity.

    Then have students remove the disks from the machines, and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Write $5\frac{345}{1000}$ in decimal form.
2. Write 3.568 in fraction form.
3. Write 0.209 in expanded form.

Homework:

1. Write in decimal form:

   a) $7\frac{35}{100}$ b) $8\frac{15}{100}$ c) $6\frac{34}{100}$ d) $\frac{125}{1000}$

2. Write in fraction form:

   a) .167 b) 8.341 c) 0.023 d) 0.129

Enrichment:

Have the students convert the following decimals to fractions in simplest form:

a) .5 = b) 1.3 =

.05 = 1.03 =

.005 = 1.003 =

TOPIC 70: Calculating Correct Change

Aim: How can we calculate the correct change?

Performance Objectives: Students will be able to:

- identify the values of coins (quarter, nickel, dime, penny)
- count coins and dollar bills
- calculate the change for 1, 5, and 10 dollar bills by using addition and subtraction
- determine the total price of item
- select the fewest coins for change

Materials:

- Apple IIe lab
- software: Math Shop by Scholastic
- play coins and dollar bills
- items for the "Price is Right" game
- index cards

Motivation:

Play "The Price is Right." Set up a display table with items children would most likely purchase. (i.e. pack of gum, ball, bag of potato chips, package of looseleaf paper, etc.) Use an index card to display prices. Place cards face down in front of each item. Have students write down the prices for each item. Hold up the index card for each item. Students that guess the correct price for all items should receive a paper coin. Play the game at least twice, but display different items.

Development:

1. Display the items from the game that were less than a dollar. Ask the students who received coins to count the amount of money they have. Review the value of the coins (quarter, nickel, dime, and penny). Have a student write the name of the coins with their values written in decimal form. i.e. quarter
   $ .25

2. Which item or items could you purchase? Find the total price of the items to be purchased. How do we find the total price? Elicit the answer addition from the students.

3. How many students have enough money to purchase an item? How much change should you receive. What operation is needed to find the change? Elicit the answer "subtraction" from the pupils. Place the form for obtaining change on the chalkboard: Amount of money
   - Price of item
   Change

4. Choose a student to complete the sales transaction. Have the rest of the students determine the amount of change needed by using the form given above and to write down the coins that can be used to provide change for the transaction. Which answer uses the fewest coins?

5. Repeat this activity once or twice.

6. Tell the students that they will practice giving change using the least number of coins in a Math Shop. Have students load in the program "Math

Shop." When the menu appears, students should press 0 to open one shop. Use the arrow keys to move the worker in front of the Boutique Shop. Press the space bar to enter the shop.

7. The program allows the students to work at their own pace. Allow at least ten to fifteen minutes on this activity.

Summary:

1. What is the value of a quarter? dime? nickel? penny?
2. Which three coins are needed to represent forty-five cents?
3. What is the total cost of the following items ?

1/2 gallon of orange juice	$ 1.29
1 dozen eggs	.89
1 loaf of bread	1.19
1 quart of milk	.89

How much change would you receive from a five dollar bill?
(Fill in the amount of change using the fewest coins below.)
_____ quarter ____ nickel _____ dime ____ penny

Homework:

Use a newspaper to find the prices of nutritious foods from the five food groups. Given a budget, students are to "shop" for items for breakfast, lunch, and/or dinner without overspending. Students should cut out information pertaining to the "purchases."

Enrichment:

Computer Activity: Use the Boutique Shop with the clock. Students must serve a large number of customers within a time limit.

TOPIC 71: Reading and Writing Decimals

Aim: How do we use place value to read and write decimals to the thousandths place?

Performance Objectives: Students will be able to:

- read three-digit decimals
- write the word name for a three-digit decimal

Vocabulary:

tenths, hundredths, thousandths

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

How do you write seventeen and seven hundredths in decimal form?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears select option 1. Type A then press ENTER. When asked for group name use MATH. When asked for number of students, type 1 and press ENTER.
   For student names - type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   If the teacher wants to use the Management System to keep track of individual students, the teacher should follow the instructions for set-up described in the manual which comes with the software.

2. Elicit from the students that seventeen and seven hundredths equals $17\ \frac{7}{100}$ in fraction form.
   Then have the students change this to decimal form. $17\ \frac{7}{100} = 17.07$

3. Repeat the procedure for the following:
   a) twenty-one and fifteen hundredths
   b) three and two hundred twenty-five thousandths

4. Ask the students to change the following decimal into its word name.
   9.42

   Elicit that you first rewrite the decimal as follows:
   $9.42 = 9\ \frac{42}{100} = 9 + \frac{42}{100}$
   Next write the word name for '9' and '$\frac{42}{100}$'

9 = nine $\frac{42}{100}$ = forty-two hundredths

Remember you must connect the whole number to the fraction with the conjunction 'and'. 9 $\frac{42}{100}$ = nine and forty-two hundredths.

5. Have the students write the word name for the following:
   a) 8.15 b) 25.008

6. Explain to the students that there is a faster method for getting the word name for a decimal.

   The word name for the decimal is taken from the place value of the digit farthest to the right in the original decimal.
   For example: 0.876

   0.876 =

1	1/10	1/100	1/1000
	8	7	6

   The '6' is in the thousandths place. Therefore 0.876 is read as $\frac{876}{1000}$ and written as eight hundred seventy-six thousandths.

7. Have the students read the following decimals and then have them write the word name for each. a) 8.76 b) 0.006 c) 34.09

8. Before the class uses the computers the teacher should review the procedures for handling the equipment.

   Have the students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as directed.

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)

   The next screen says: You are now ready to begin your placement check. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down the CONTROL and type the letter T. Type 1 and press ENTER for the lesson number.

9. Have the students go through the first part of the lesson as a review. The questions are randomized so the pProblems will be different.

   After the first and second round of questions, the students will reach the screen that tells how well they performed. When the students see the prompt they should type N; ENTER.

10. An example is given that first shows the word name for a number, and then the matching numeral. This is followed by a six problem drill.

11. If a mistake is made during the drill, a tutorial screen appears, showing the matching equivalent fraction. If a second mistake is made on the same problem, the tutorial screen gives the correct answer.

12. When the screen appears showing the number of correct out of 6, you can check the groups' progress. After you clarify any misunderstandings you may have them do more problems by typing Y and pressing ENTER.
If the student enters N, the program will continue. If the student gets 8 correct on the first test, they will automatically go on to the next test, writing the matching numeral for the word name which is given. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or whether they would have to repeat it.

13. Allow students about 20-25 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. How do you read the decimal 0.653?
2. How can we use the place value chart to read decimals?
3. Write the word name for 0.653 .

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Have the students write the number 154.876 in expanded form.

$$154.876 = 1(100) + 5(10) + 4(1) + 8(1/10) + 7(1/100) + 6(1/1000)$$

The teacher can expand this enrichment to expanded form using exponents including negative powers.

$$154.876 = 1 \times 10^{2} + 5 \times 10^{1} + 4 \times 10^{0} + 8 \times \frac{1}{10} + 7 \times \frac{1}{100} + 6 \times \frac{1}{1000}$$

$$154.876 = 1 \times 10^{2} + 5 \times 10^{1} + 4 \times 10^{0} + 8 \times \frac{1}{10^{1}} + 7 \times \frac{1}{10^{2}} + 6 \times \frac{1}{10^{3}}$$

$$154.876 = 1(10^{2}) + 5(10^{1}) + 4(10^{0}) + 8(10^{-1}) + 7(10^{-2}) + 6(10^{-3})$$

TOPIC 72: Comparing Decimals

Aim: How do we compare two numbers in decimal form?

Performance Objectives: Students will be able to:

- determine when decimals are equivalent
- demonstrate the procedure for renaming decimals into equivalent decimal form
- determine when one decimal is greater than, less than, or equal to another decimal

Vocabulary:

equivalent decimal

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Which decimal is greater?
.21 or .039

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   If the teacher wants to use the Management System to keep track of individual students, the teacher should follow the instructions for set-up described in the manual which comes with the software.

2. Elicit the fractional equivalents of .21 and .039.

   .21 .039

   $$\frac{21}{100} \qquad \frac{39}{1000}$$

   Compare the two fractions.
   Rename the fractions into equivalent form with a common denominator of 1000.

   $$\frac{210}{1000} \qquad \frac{39}{1000}$$

   Elicit that $\frac{210}{1000}$ is greater than $\frac{39}{1000}$

Therefore, .21 is greater than .039.

$$.21 > .039$$

3. Ask the class to write the following in decimal equivalent form:

$$\frac{21}{100} = .21$$

$$\frac{210}{1000} = .210$$

Since $\frac{21}{100} = \frac{210}{1000}$ .21 must equal .210.

Tell the class that .21 and .210 are equivalent decimals.

Have the class rename the following decimals as fractions:

.6, .60, .600

$\frac{6}{10}$, $\frac{60}{100}$, $\frac{600}{1000}$

Have the students show that the fractions are equivalent.

Elicit that since the fractions are equivalent, then their decimal form must also be equivalent.

$$.6 = .60 = .600$$

Elicit from the class that equivalent decimals may be formed by placing zeros to the right of the last digit of the decimal.

4. Have the students write the indicated equivalent decimal for the following:

a) .5 (hundredths) b) .87 (thousandths)
c) .3 (thousandths) d) 4.3 (hundredths)

5. Return to the motivation problem and ask the students how we could solve it without rewriting the decimals as fractions.
Elicit that we could rewrite the original decimals as equivalent decimals to the thousandths place.

.21 .039
.210 .039
therefore .21 > .039

Have the class do the following:

Answer using '>', '<', or '='

a) .8 .090 b) .5 .50
c) .123 .1 d) 2.1 .21

6. Before the class uses the computers the teacher should review the procedures for handling the equipment.

Have the students load the lesson disk. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as directed.

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.

Type A for the password again; ENTER.
(You may choose a different password.)

The next screen says: You are now ready to begin your placement check. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down the CONTROL and type the letter T. Type 1 and press ENTER for the lesson number.

7. The student is shown four examples, all following the same format. This is followed by an eight-problem drill.

NOTE: a) Students should have paper and pencil handy.
b) If a mistake is made before the ENTER key is pressed, use the BACKSPACE key to erase.
c) In order to enter the proper signs, (>, =, <) the shift key must be depressed at the same time as the comparison key.

If a mistake is made during the eight-problem drill a tutorial screen will appear and form the appropriate equivalent fractions to the decimals that are being compared. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

8. After the drill, a score is given. To practice more of the same type of problem, Students may type Y and press ENTER.

9. Allow students about 15-20 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Rename .89 as an equivalent decimal in thousandths.
2. What is the method for renaming decimals in equivalent decimal form?
3. Explain why .99 is less than 1.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Have the students write word name and fraction name for the following:

DECIMAL	WORD NAME	FRACTION
9.3		
.93		
.093		
23.0		
2.30		
.230		
.023		

TOPIC 73: Rounding Decimals

Aim: How do we round decimals?

Performance Objectives: Students will be able to:

- round decimals to the nearest whole number, tenth or hundredth

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Pedro sees a sale in a store window that offers 10 pens for $1.98. How much would he pay if he bought only 1 pen?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   If the teacher wants to use the Management System to keep track of individual students, the teacher should follow the instructions for set-up described in the manual which comes with the software.

2. Elicit from the students that they must divide $1.98 by 10.
   $1.98/10 = 19 8/10 cents
   Elicit from the class that there is no coin that is equivalent to 8/10 (0.8) of a cent. Ask the students what they expect to be charged.
   Elicit: $.20

3. Review the procedure for rounding whole numbers. Ask the class what would 38 be rounded off to the nearest ten. (40)
   Elicit the steps used to find the answer.
   a) Determine between what multiples of ten 38 lies. (30 and 40)
   b) Determine whether 38 is closer to 30 or 40.
      38 - 30 = 8 40 - 38 = 2
      Elicit that it is closer to 40.
   c) Mention that if the number is greater than 35, it is rounded to 40.
      Note: By convention, if a number is equal to the midpoint of the interval, it is always rounded to the greater value.

   Have the class round off the following whole numbers as indicated.
   a) 67 (nearest ten)
   b) 24 (nearest ten)
   c) 145 (nearest ten)
   d) 234 (nearest hundred)

4. Have the students apply the procedure for rounding numbers to decimals.

Ask the class how we would determine what 2.4 would be, rounded to the nearest whole number.

a) Elicit what two whole numbers 2.4 lies between. (2 and 3)
   Illustrate on the number line.

```
<--|-|-|-|-*-|-|-|-|-|-|->
   2       ↑           3
          2.4
```

b) Elicit that 2.4 is closer to 2 than to 3. It is only 4 units (using .1 units) from 2 on the number line while it is 6 units (using .1 units) from 3.

```
<-|---|---|---|---*---|---|---|---|---|---|->
  2               ↑                       3
 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0
```

   If the students have already learned to subtract decimals, demonstrate the differences by computation.

```
        2.4 - 2.0 = .4        3.0 - 2.4 = .6
```

   By the alternative method, the midpoint of the interval is 2.5. 2.4 is less than 2.5, therefore we round to 2.

5. Turn to the motivation problem and ask students why 19.8 cents rounds to 20 cent.

6. Have the class round the following decimals to the nearest whole number.
   a) 6.4   b) 8.2   c) 3.5

7. Ask the class what .36 would be, to the nearest tenth. Have them draw a number line and show you.

   Have the class find the following to the nearest tenth.
   a)   .67   b)   .37   c)   .89

8. Ask the class what .476 would be to the nearest hundredth.

```
<-|---|---|---|---|---|---*---|---|---|---|->
 .47                      ↑              .48
                        .476
```

   Next, elicit that .476 is closer to .48.

```
<-|---|---|---|---|---|---*---|---|---|---|->
 .47                    .476             .48
 .470                   .476            .480
```

   Have the class find the following to the nearest hundredth.
   a)   .375   b)   .893   c)   .552

9. Before the class uses the computers, review the procedures for handling the equipment.

   Have students insert the lesson disk carefully into drive A and turn on the computer and monitor. After the welcome screen appears have the student press ENTER, and answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.

Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)
The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 2 and ENTER for the lesson number.

10. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different.

    After the first round of questions, the students will reach the screen that tells how well they performed, when the students see the prompt they should type N and ENTER.

11. The student will see two examples for rounding off decimals. The first one is rounded to the nearest whole number, and the second one is rounded to the nearest tenth.

    This is followed by a six-problem drill.

    If a mistake is made during the drill, a tutorial screen will appear. It will review the technique used in the examples above. If a second mistake is made on the same problem, the answer will be given.

12. When the screen appears showing the number of correct answers, you may either have them do more problems by typing Y and pressing ENTER, or have the student enter N, and the program will continue. Next to appear will be the accuracy check. If the students achieve mastery, they will go on to the next drill. If not, they will repeat it.

13. Allow students about 20-25 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers.

Summary:

1. State the procedure for rounding decimals to the nearest whole number, tenth, and hundredth.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Have the students round the following numbers to the nearest hundred, ten, whole number, tenth, and hundredth.

a) 3457.753
b) 1111.111
c) 5555.555
d) 9999.999

Solutions:

nearest				
hundred:	3500	1100	5600	10000
ten:	3460	1110	5560	10000
whole number:	3458	1111	5556	10000
tenth:	3457.8	1111.1	5555.6	10000.0
hundredth:	3457.75	1111.11	5555.56	10000.00

TOPIC 74: Adding Decimals

Aim: How do we add numbers in decimal form?

Performance Objectives: Students will be able to:

- add decimals
- explain the rule for adding decimals.

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Ellen wanted to buy some books that cost $8.98, $4.23, $7.98, and $6.50. How much will the books cost altogether?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A and turn on the computer and monitor. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. This will be used for identification purposes later when the class signs on. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   Follow the screen instructions for putting management information on lesson disks. At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit from the class that this is an addition problem.
   $8.98 + 4.23 + 7.98 + 6.50 =$
   Tell the class that today we are going to learn how to add decimals.

3. Have the students add 0.5 + 0.3 Elicit that we can rename the decimals into fraction form.

   $$0.5 + 0.3 =$$
   $$\frac{5}{10} + \frac{3}{10} = \frac{8}{10} = 0.8$$

   Demonstrate to the class the following:
   Vertical form:
   $$\begin{array}{r} 0.5 \\ +\ 0.3 \\ \hline 0.8 \end{array}$$
   Elicit that it is easier to simply add the values in the tenths column to get the answer rather than changing the decimals to fraction form and then adding.

4. Have the students add 3.5 + 2.8 Elicit that we can rename the decimals into fraction form.

$$3.5 + 2.8 =$$

$$3\frac{5}{10} + 2\frac{8}{10} = 5\frac{13}{10} = 6\frac{3}{10} = 6.3$$

Demonstrate to the class the following:

Vertical form:

$$\begin{array}{r} 3.5 \\ +\ 2.8 \\ \hline 6.3 \end{array}$$

Elicit that it is easier to simply add the values in the vertical form to get the answer rather than changing the decimals to fraction form and then adding.

5. Have the students solve the motivation problem.

$$\begin{array}{r} \$\ \ 8.98 \\ 4.23 \\ 7.98 \\ +\ \ 6.50 \\ \hline \$\ 27.69 \end{array}$$

6. Have the students add 13.4 + 8.28 using the vertical form. Elicit from the students the proper set up.

$$\begin{array}{r} 13.4 \\ +\ \ 8.28 \\ \hline \end{array}$$

Elicit from the class that 13.4 = 13.40 (equivalent decimal form). Rewrite the problem and add.

$$\begin{array}{r} 13.4 \\ +\ \ 8.28 \\ \hline \end{array} \quad = \quad \begin{array}{r} 13.40 \\ +\ \ 8.28 \\ \hline 21.68 \end{array}$$

7. Have the students do the following:

a) $\begin{array}{r} 74.8 \\ +\ 13.9 \\ \hline \end{array}$ b) $\begin{array}{r} 2.14 \\ +\ 13.9 \\ \hline \end{array}$ c) $\begin{array}{r} 8.89 \\ +\ 7.125 \\ \hline \end{array}$

8. Elicit from the students the procedure for adding decimals.
   a) Write the numbers in vertical form.
   b) Align the digits of the numbers by place value.
   c) Add the columns as you would do in a whole number problem.
   d) Remember to keep the decimal point in the sum aligned with the other decimal points in the addends.

9. Before the class uses the computers the teacher should review the procedures for handling the equipment.

   Have the students load the lesson disk. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as follows:

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)

   The next screen says: You are now ready to begin your placement check. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. Type 3 and press ENTER for the lesson number.

10. The student is shown two examples of decimal addition following the method described in #4 above. First a pair of decimals written horizontally, is rewritten vertically, making sure that the decimal points line up properly. Then place value is employed to make sure that the addends are in the proper place. Next, a similar type of problem is done, but this time using thousandths in one of the addends. This means that the other addend should be rewritten as an equivalent decimal. This is followed by a five-problem drill.

    NOTE: a) Students should have pencils and paper handy.
    b) If a mistake is made before ENTER is pressed, use the BACKSPACE key to erase.

    If a mistake is made during the five-problem drill, a tutorial screen will appear and set the problem up in vertical form. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

11. When the screen appears showing the number of correct out of 5, you can check the groups' progress. After you clarify any misunderstandings, you may have them do more problems by typing Y, ENTER.

    NOTE: The student may stay in this drill cycle as long as you prefer simply by entering Y each time this screen appears. The problems are randomized.

    If no further practice is desired, leave the computers at this point, since the lesson should be continued at another time.

12. Allow students about 10-15 minutes to complete the computer-directed activity.

    Tell students to remove the disks, and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Explain the procedure for adding decimals.

Homework:

The teacher should choose appropriate problems from the students' textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Consider the following sequences:

.5, 1, 1.5, 2, ...

0, .1, .3, .6, 1, ...

.1, .1, .2, .3, .5, .8, ...

What would be the next three numbers for each sequence?

Solutions:

2.5, 3, 3.5	(add .5 to the last term to create the next term in the sequence)
1.5, 2.1, 2.8	(0, 0 + .1, .1 + .2, .3 + .3, .6 + .4, 1 + .5, 1.5 + .6, 2.1 + .7, ...)
1.3, 2.1, 3.4	(add the last two terms to create the next term in the sequence)

TOPIC 75: Subtracting Decimals

Aim: How do we subtract decimals?

Performance Objectives: Students will be able to:

- subtract decimals
- explain the rule for subtracting decimals.

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Shirley bought a notebook for \$2.50, a ruler for \$.35, a protractor for \$.75, and a compass for \$.98. What would her change be from a \$10 bill?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A and turn on the computer and monitor. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. This will be used for identification purposes later when the class signs on. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER. Follow the screen instructions for putting management information on lesson disks.

   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit from the class that we should first add all the items together and then subtract the sum from \$10.

$$\begin{array}{r} \$2.50 \\ .35 \\ .75 \\ +\ \ .98 \\ \hline \$4.58 \end{array} \qquad \$10 - 4.58 = \underline{\qquad\qquad}$$

   Tell the class that today we are going to learn how to subtract decimals.

3. Review with the class the procedures for addition of decimals with an emphasis on the arrangement of the decimals for addition.

   Explain to the class that we use a similar procedure for subtraction. The only difference is that we subtract rather than add once the decimals are set up in vertical form.

e.g. $.45 - .23 =$ $$\begin{array}{r} .45 \\ -\ .23 \\ \hline .22 \end{array}$$

4. Have the students do the following:

$$\text{a)}\ \begin{array}{r} 5.37 \\ \underline{-\ 3.12} \end{array} \qquad \text{b)}\ \begin{array}{r} 3.72 \\ \underline{-\ 1.56} \end{array} \qquad \text{c)}\ \begin{array}{r} 6.07 \\ \underline{-\ 3.27} \end{array}$$

5. Let's return to our initial (motivation) problem. We found the sum of what Shirley bought to be equal to $4.58.
Our next step was to subtract this sum from $10.

Set up: $$\begin{array}{r} \$10. \\ \underline{-\ 4.58} \end{array}$$

Notice we have written nothing in the tenths and hundredths columns. What should we write in these columns and what allows us to do this? (zeros & equivalent decimals)

10. = 10.00

Rewrite the problem and solve.

$$\begin{array}{r} \$10.00 \\ \underline{-\ 4.58} \\ \$\ 5.42 \end{array}$$

6. Have the students do the following problems:
   a) $12 - 3.50   b) $45 - 6.45

7. Elicit from the students the procedure for subtracting decimals.
   a) Write the numbers in vertical form.
   b) Align the digits of the numbers by place value.
   c) If necessary rename the minuend or the subtrahend into equivalent decimal form so that both have the same number of decimal places.
   d) Find the difference.

8. Before the class uses the computers review the procedures for handling the equipment.

   Have the students load the lesson disk. After the welcome screen appears, have the students press ENTER. Answer the questions on the screen as directed.

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)

   The next screen says: You are now ready to begin your placement check. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T. They will then proceed to the next screen which will ask them to "Type the number of the lesson you want." Have the class type 3 and press ENTER.

9. Have the students go through the first part of the lesson as a review. The questions are randomized so the problems will be different.

   After the first round of questions, the students will reach the screen that tells how well they performed, when the students see the prompt they should type N; ENTER.

10. The student is then shown two examples of decimal subtraction following the method described above. First, a pair of decimals written horizontally, is rewritten vertically, making sure that the decimal points line up properly. Then place value is employed to make sure that the minuend and subtrahend are in the proper place. Finally the

subtraction is done.
Next, a similar type of problem is shown, but this time using thousandths in the subtrahend. This means that the minuend should be rewritten as an equivalent decimal before the subtraction is done.

This is followed by a five-problem drill.

NOTE: a) Students should have pencils and paper handy.
b) If a mistake is made before ENTER is pressed, use Backspace to erase.

If a mistake is made during the five-problem drill, a tutorial screen will appear and set the problem up in vertical form. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

11. When the screen appears showing the number of correct, you can check the groups progress. Ask the students to raise their hands when they get to this point and walk over to check their result. After you clarify any misunderstandings you may have them do more problems by typing Y; ENTER.

NOTE: The student may stay in this drill cycle as long as you prefer simply by entering Y each time this screen appears. The problems are randomized.

If the student enters N, the program will continue. Next to appear will be the accuracy check. This part of the program is self-explanatory and works on the principle of 4 correct answers out of a possible 5. If the students get 4 correct on the first test, they will automatically go on to the next test. Similarly, the students may progress onto the final test. At the end of this sequence, the students are told whether they have achieved mastery of the lesson or whether they should repeat it.

12. Allow students about 20-25 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Explain the procedure for subtracting decimals.

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Consider the following sequences:

0, .8, 1.6, 2.4, ...
0, 1.2, .7, 1.9, 1.4, ...
.2, .2, .1, .3, .2, .5, .4, .9, ...

What would be the next three numbers for each sequence?

Solutions:

3.2, 4, 4.8	(add .8 to the last term to create the next term)
2.6, 2.1, 3.3	(alternate between adding 1.2 to the last term to create the next term and subtracting .5 from the last term to create the next term)
.8, 1.7, 1.6	(alternate between adding the the last two terms to create the next term and and subtracting .1 from the last term to create the next term)

.2
+ .2 =.2
.2 - .1 =.1
.2 + .1 =.3
.3 - .1 =.2
.3 + .2 =.5
.5 - .1 =.4
.5 + .4 =.9
.9 - .1 =.8
.9 + .8 = 1.7
1.7 - .1 = 1.6

TOPIC 76: Multiplying Decimals

Aim: How do we multiply decimals?

Performance Objectives: Students will be able to:

- multiply a decimal by a whole number
- multiply a decimal by a decimal
- state and apply the procedure for multiplying decimals

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

How much change from a $10 bill would May Ling receive if she bought three packages of cookies at $2.35 each?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A and turn on the computer and monitor. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. This will be used for identification purposes later when the class signs on. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   Follow the screen instructions for putting management information on lesson disks.

   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit that you need to find
   a) the cost of the cookies, and
   b) the change from the $10 bill.

   Elicit from the class that there are two operations involved in this problem. You can either solve it by using multiplication and subtraction or you can use addition and subtraction to find the answer.

3. Cost of the cookies
   a) Elicit from the class how we would find the cost of the cookies by addition.

$$\begin{array}{r} \$2.35 \\ 2.35 \\ +\ \ 2.35 \\ \hline \$7.05 \end{array}$$

   The cost of the cookies is $7.05

   b) Elicit from the class how we would find the cost of the cookies by multiplication.

$$\begin{array}{r} \$2.35 \\ \underline{\text{x} \quad 3} \\ \$7.05 \end{array}$$

(note: If the students have difficulty with multiplying a decimal by a whole number continue with step 5, otherwise go to step 6.)

4. Have the students solve the motivation problem by subtracting the cost from $10.

$$\begin{array}{r} \$10.00 \\ \underline{-\ \ 7.05} \\ \$2.95 \end{array}$$

5. Have the students multiply 1.2 times 3. Elicit that 1.2 can be rewritten as the fraction 12/10.

Multiply: 1.2 x 3

$$\frac{12}{10} \times \frac{3}{1} = \frac{36}{10}$$

Rewrite the answer in decimal form.

36/10 = 3.6

Lets write the problem in vertical form.

$$\begin{array}{r} 1.2 \\ \underline{\text{x} \quad 3} \\ 3.6 \end{array}$$

Elicit from the students that we multiply the number as we do in any whole number multiplication problem. The only difference is the decimal point. Elicit that there is only one decimal place in 1.2 and the product has only one decimal place.

Have the students do the following:

$$1)\ \begin{array}{r} 2.3 \\ \underline{\text{x} \quad 3} \end{array} \qquad 2)\ \begin{array}{r} 8.6 \\ \underline{\text{x} \ \ 5} \end{array} \qquad 3)\ \begin{array}{r} 7.2 \\ \underline{\text{x} \ \ 6} \end{array}$$

6. Present the class with the following multiplication problem and elicit possible methods for finding the product.

.2 x .9 =

Elicit that we could find the product by rewriting the decimals in fraction form and then multiplying.

$$\frac{2}{10} \times \frac{9}{10} = \frac{18}{100}$$

Rename the product as a decimal.

18/100 = .18

Lets look at the vertical form of multiplying decimals.

$$\begin{array}{rrl} .2 & 1 & \text{decimal place} \\ \underline{\text{x } .9} & \underline{+\ 1} & \text{decimal place} \\ .18 & 2 & \text{decimal places} \end{array}$$

Elicit from the class that the product of 2 x 9 = 18. Also elicit that .2 has one decimal place and .9 has one decimal place. If we add the number of decimal places in the factors the sum equals the number of decimal places in the product (1 + 1 = 2). Make sure the class understands the process before continuing.

7. Have the students find the product of 1.26 x .9 by both methods.

a) 1.26 x .9

$$\frac{126}{100} \times \frac{9}{10} = \frac{1134}{1000} = 1.134$$

b)

$$\begin{array}{rrl} & 1.26 & 2 \text{ decimal places} \\ \times & .9 & +\,1 \text{ decimal place} \\ \hline & 1.134 & 3 \text{ decimal places} \end{array}$$

8. Have the class do the following: a) 2.5 x .3 b) 1.25 x .12 c) .6 x .45

9. Elicit the procedures for multiplying decimals.
   a) Multiply the decimal numbers as if they were whole numbers.
   b) Count the number of decimal places in each factor. The sum of these decimal places will determine the decimal of the product.
   c) Write the product.

10. Before the class uses the computers review the procedures for handling the equipment.

    Have the students load the lesson disk. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as follows:

    Type A for the first name; ENTER.
    Type MATH for the group name; ENTER.
    Type 1 for the student number; ENTER.
    Type A for the password; ENTER.
    Type A for the password again; ENTER.
    (You may choose a different password.)

    The next screen says: YOU ARE NOW READY TO BEGIN YOUR PLACEMENT CHECK. DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them press CONTROL and the letter T. They will then proceed to the next screen which will ask them to: "Type the number of the lesson you want." Have the class type 4, then press ENTER.

11. The students will be shown two examples of decimal multiplication using the method from #6 above. In the first example, two tenths place decimals are renamed as fractions and then multiplied. The product, which is a fraction with a denominator of 100 is then renamed as a decimal. The second example shows the multiplication of a mixed number in decimal form, by a hundredths place decimal. The same procedure is used, except this time the first fraction is an improper fraction.

    This is followed by a four-problem drill.

    NOTE: a) Students should have pencils and paper handy.
    b) Remind students to enter the decimal point in the proper place, using a period.

    If a mistake is made during the four-problem drill, a tutorial screen will appear and use the same method described above. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

12. When the screen appears showing the number of correct, have the students enter N, and the program will continue with another example of decimal multiplication, this time using the standard algorithm presented in #9 above.

This is followed by a six-problem drill. See NOTE in #11 above. If a mistake is made during the six-problem drill, a tutorial screen will appear and review the standard algorithm described above. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

13. When the screen appears showing the number of correct, have the students enter N, and the program will continue. Next to appear will be the accuracy check. This part of the program is self-explanatory and works on the principle of 4 correct answers out of a possible 5. At the end of this sequence, the student is told whether they have achieved mastery of the lesson or should repeat it.

14. Allow students about 15-20 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. What is the procedure for multiplying a decimal times a whole number?
2. What is the procedure for multiplying a decimal times a decimal?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Estimate the products and list the examples from least to greatest estimated product. Then calculate the exact answers to confirm the listing.

TOPIC 77: Dividing Decimals

Aim: How do we divide decimals?

Performance Objectives: Students will be able to:

- divide a decimal by a whole number
- divide a decimal by a decimal
- state and apply the procedure for dividing decimals

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Mariluz spent $4.41 on chicken. If she bought 9 pounds of chicken, what was the cost per pound?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A and turn on the computer and monitor. When the main menu appears, select option 1. Type A then press ENTER. When asked for group name use MATH. This will be used for identification purposes later when the class signs on. Type 1 and press ENTER for number of students. For student names, type A for first name; ENTER, and A for the last name; ENTER. For the next three prompts, type N; ENTER.

   Follow the screen instructions for putting management information on lesson disks.

   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit from the class that we must divide $4.41 by 9 to determine the price per pound of the chicken.

   $$4.41 \div 9$$

   Have the students change the decimal to fraction form.

   $$\frac{441}{100} \div 9$$

   Use the division algorithm for fractions to solve the problem.

   $$\frac{441}{100} \times \frac{1}{9} = \frac{441}{900} = \frac{49}{100} = .49$$

   An alternate method for solving the problem would be to have the students rewrite the problem in fraction form and then multiply the numerator and denominator of the fraction by 100 since the decimal in the numerator has two decimal places.

   $$\frac{4.41}{9} \times \frac{100}{100} = \frac{441}{900} = \frac{49}{100} = .49$$

3. Elicit from the students that both methods are too time consuming.

3. Elicit from the students that both methods are too time-consuming. Tell the class that we can use the standard division algorithm for whole numbers to solve the problem.

$$\begin{array}{r} .49 \\ 9\overline{)4.41} \end{array}$$

Elicit the procedure dividing a decimal by a whole number from the class.

a) Divide in the same manner as you would for whole numbers.

b) Write the decimal in the quotient directly above the decimal in the dividend.

4. Have the students do the following:

a) $5\,\overline{)2.25}$

b) $11\,\overline{)2.431}$

5. Revise the motivation problem as follows and ask the students to find the answer.

Mariluz spent \$4.41 on chicken. If the chicken cost \$.98 per pound, how many pounds did she buy?

Elicit that this problem can be solved by dividing 4.41 by .98.

$$4.41 \div .98 = \underline{\qquad\qquad}$$

Ask how this division problem differs from the original problem. Elicit that we are dividing a decimal by a decimal.

Using the procedure above have the students rewrite the division problem as a fraction and multiply the numerator and denominator by a power of 10. Elicit from the students that we should use 100 because the denominator has two decimal places.

$$\frac{4.41}{.98} \times \frac{100}{100} = \frac{441}{98} = 4.5$$

Elicit the answer: Mariluz can buy 4.5 pounds of chicken with \$4.41.

6. Tell the class that we can use the division algorithm for dividing a decimal by a decimal. Demonstrate:

Fraction Method

$$\frac{4.41}{.98} \times \frac{100}{100}$$

$$\frac{441}{98}$$

$$4.5$$

Algorithm

$$.98\,\overline{)4.41}$$

$$.98 \times 100\,\overline{)4.41 \times 100}$$

$$98\,\overline{)441.00}$$

$$\begin{array}{r} 4.5 \\ \underbrace{\cancel{.}98.}\,\overline{)4\underbrace{\cancel{.}41.}0} \end{array}$$

7. Demonstrate the algorithm:

$$\begin{array}{r} 46.9 \\ \underbrace{\cancel{.}05.}\,\overline{)2\underbrace{\cancel{.}34.}5} \end{array}$$

Elicit the steps in the procedure.

a) Move the decimal point to the right in the divisor and the dividend the same number of decimal places as there are in the divisor.

b) Divide in the same manner as you would for whole numbers.
c) Write the decimal in the quotient directly above the decimal in the dividend.

Have the students divide 3.64 by .7

8. Before the class uses the computers, review the procedures for handling the equipment.

Have the students load the lesson disk. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as directed.

Type A for the first name; ENTER.
Type MATH for the group name; ENTER.
Type 1 for the student number; ENTER.
Type A for the password; ENTER.
Type A for the password again; ENTER.
(You may choose a different password.)

The next screen says: "YOU ARE NOW READY TO BEGIN YOUR PLACEMENT CHECK." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them press CONTROL and the letter T. They will then proceed to the next screen which will ask them to: "Type the number of the lesson you want." Have the class type 5, then ENTER.

9. The students will be shown two examples of decimal division using the method from #6 above. In the first example, a decimal is divided by a decimal. In the second example a whole number is divided by a decimal.

This is followed by a four problem drill.

NOTE: a) Students should have pencils and paper handy.
b) Remind students to enter the decimal point in the proper place, using a period.
c) If a mistake is made before ENTER is pressed, use BACKSPACE to erase.

If a mistake is made during the four problem drill a tutorial screen will appear and use the same method described above. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

10. When the screen appears showing the number of correct, you may have the students do more problems by typing Y and pressing ENTER.

NOTE: The student may stay in this drill cycle as long as you prefer simply by entering Y each time this screen appears. The problems are randomized.

11. If no further practice is desired, leave the computers at this point, since the lesson should be continued at another time.

12. Allow students about 10-15 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. State the procedures for dividing a decimal by a whole number.
2. Explain the procedures used for finding the quotient in the following problem.

$$.09\,\overline{)\,.9081}$$

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Consider the following sequence:

.5, .25, .75, .375 ...

What would be the next three numbers in the sequence?

Solutions:

.125, .5625, 1.6875 (Alternate between dividing the last term by 2 to create the next term and multiplying the last term by 3 to create the next term.)

.5/2 = .25
.25 x 3 = .75
.75/2 = .375
.375 x 3 = 1.125
1.125/2 = .5625
.5625 x 3 = 1.6875

TOPIC 78: Converting Fractions to Decimals

Aim: How do we convert fractions to decimals?

Performance Objectives: Students will be able to:

- convert fractions with denominators other than powers of ten to decimal form
- recognize a terminating decimal
- recognize a repeating non-terminating decimal

Vocabulary: terminating decimal, repeating non-terminating decimal

Materials:

- MS DOS computer lab with 64K and Color/Graphics Monitor Adapter
- MS DOS diskette with Basica
- software: Elementary Mathematics Classroom Learning System (Fractions and Decimals - Decimal Disk) by D.C. Heath

Motivation:

Karen, David and Sandra had three dollars to spend altogether. They went to the candy store and bought four comic books. If the comic books each cost the same amount, how much did one comic book cost?

Development:

1. If you have not prepared the software for classroom use, follow the procedure below.

   Place the management disk in drive A, when the main menu appears select option 1 and type "A" and press enter. When you are asked to type group name use MATH. Type 1 and ENTER for NUMBER OF STUDENTS. For the last three prompts, type N and ENTER for each.
   Follow the screen instructions for putting management information on lesson disks.

   Follow the screen instructions for putting management information on lesson disks.

   At this point the lesson disks are prepared and ready to be used by the students when the class comes in.

2. Elicit from the class that we must divide the $3 the children spent, by 4, to determine the price of a comic book.
   Have the students write this in the standard algorithm form.

   $$4\overline{)3}$$

   Elicit that 3 is not divisible by 4, and that the answer is less than $1.00.
   Ask the students for equivalent decimal names for 3. (3 = 3.0 = 3.00 = 3.000)

   Rewrite the division problem using the equivalent decimal names for 3 and divide. Start with 3.0.

   $$\begin{array}{r} .7 \\ 4\overline{)3.0} \\ \underline{2\ 8} \\ 2 \end{array}$$

Since there is still a remainder rewrite 3.0 as 3.00.

```
     .75
  4)3.00
    2 8
      20
      20
```

3 4 = $\frac{3}{4}$ = .75

Elicit from the class that each comic cost $.75.

Tell the class that .75 is called a terminating decimal.

Have the class repeat the procedure for the following problems.

a) $5 \div 8 = \frac{5}{8} =$

b) $7 \div 20 = \frac{7}{20} =$

3. Have the class divide 2 by 3 using the above procedure.

```
3)2

    .6
  3)2.0
    1 8
      2

    .66
  3)2.00
    1 8
      20
      18
       2

    .666
  3)2.000
    1 8
      20
      18
       20
       18
        2
```

Elicit from the class that the 6 in the quotient will repeat endlessly. $\frac{2}{3}$ = .66666... is called a repeating non-terminating decimal.

$\frac{2}{3} = .\overline{6}$ The bar above the 6 symbolizes that the digit 6 repeats endlessly

Have the class divide 7 by 11. $7\overline{)11}$

Elicit that the digits 63 repeat endlessly in the quotient. Have the students write the repeating non-terminating decimal for 7/11.

$\frac{7}{11} = .\overline{63}$

Tell the class that there are equivalent forms of the repeating decimal. Illustrate.

$$\frac{7}{11} = .\overline{63} = .63\overline{63} = .6363\overline{63}$$

4. Before the class uses the computers review the procedures for handling the equipment.

   Have the students load the lesson disk. After the welcome screen appears have the students press ENTER. Answer the questions on the screen as directed.

   Type A for the first name; ENTER.
   Type MATH for the group name; ENTER.
   Type 1 for the student number; ENTER.
   Type A for the password; ENTER.
   Type A for the password again; ENTER.
   (You may choose a different password.)

   The next screen says: "You are now ready to begin your placement check." DO NOT LET THE STUDENTS PRESS ENTER AT THIS POINT. Instead, have them hold down CONTROL and type the letter T simultaneously. They will then proceed to the next screen which will ask them to: Type the number of the lesson you want. Have the class type 5, then ENTER.

5. Have the students go through the first part of the lesson as a review of decimal division. The questions are randomized so the problems will be different.

   After the first round of questions, the students will reach the screen that tells how well they performed. When the students see the prompt, they should type N and press ENTER.

6. The students will be shown two examples in which the "fraction corresponds to a terminating decimal", as shown in #2 above.

   This is followed by a four-problem drill.

   NOTE: a) Students should have pencils and paper handy.
   b) Remind students to enter the decimal point in the proper place, using a period.
   c) If a mistake is made before ENTER is pressed, use BACKSPACE to erase.

   If a mistake is made during the four-problem drill, a tutorial screen will appear and use the same method described above. If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

7. When the screen appears showing the number of correct, you can check the groups' progress. Ask the students to raise their hands when they get to this point and walk over to check their result. After you clarify any misunderstandings you may have them do more problems by typing Y and pressing ENTER.

   NOTE: The student may stay in this drill cycle as long as you prefer simply by entering "Y" each time this screen appears. The problems are randomized.

8. If the student enters N, the program will continue. The student will be shown two examples in which the "fraction corresponds to a repeating decimal", as shown in #3 above.

   This is followed by a four-problem drill. See NOTE in #6 above. If a mistake is made during this four-problem drill a tutorial screen will appear and review the standard algorithm described above.

   NOTE: In this section the student is asked to round the answer to the nearest hundredth. If this is not done properly, it will be counted as a mistake.

   If a second mistake is made on the same problem, the tutorial screen will continue, but this time giving the solution to the problem.

9. When the screen appears showing the number of correct, you can check the group's progress. Ask the students to raise their hands when they get to this point and walk over to check their result. After you clarify any misunderstandings you may have them do more problems by typing Y and pressing ENTER.

   See NOTE in #7 above.

   Have students enter N, the program will continue. Next to appear will be the accuracy check. This part of the program is self-explanatory and works on the principle of 3 correct answers out of a possible 4, for the check on decimal by decimal division. If the students get 3 correct on the first test, they will automatically go on to the next test. The mastery level for the next section on converting fractions to decimals is 4 out of 5.
   At the end of this sequence, the students are told whether they have achieved mastery of the lesson or whether they should repeat it.

10. Allow students about 20-25 minutes to complete the computer-directed activity. Then have students remove the disks and turn off the computers. Remind the students to put the diskettes into their protective covers carefully.

Summary:

1. Explain how we would convert 5/8 into a decimal.
2. What kind of decimal is .625?
3. Explain how we would convert 1/3 into a decimal.
4. What kind of decimal is .333?

Homework:

The teacher should choose appropriate problems from the students textbook for homework.

The teacher should include problems on earlier work so that the homework assignment is spiraled.

Enrichment:

Have the class convert the following to decimal form.

1/2 =   1/9 =
1/20 =   1/90 =
1/200 =   1/900 =

TOPIC 79: Finding the Percent of a Number

Aim: How can we find the percent of a number?

Performance Objectives: Students will be able to:

- understand a percentage of a number
- solve a given percent of a number
- rewrite a percent as a fraction
- rewrite a percent as a decimal

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.

Motivation:

Write the following on the chalkboard:

I will give you 50% of all the pens in my desk. What does that mean? If I have 8 pens, how many will I give you? How can we solve the problem mathematically? How can our knowledge of fractions help?

$50\% = \frac{1}{2}$ and $\frac{1}{2} \times 8 = 4$

$50\% = 0.50$ and $0.50 \times 8 = 4$

Development:

1. After the motivation, do a number of problems showing a percentage of a whole number being solved by converting the percent to a fraction, or a decimal and then being multiplied by the whole number.

2. Tell the students that the program they are about to use will teach them how to find the percentage of whole numbers.

3. Prior to bringing the class into the computer lab, the teacher must place the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A - ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B - RETURN TO TITLE PAGE. This must be done for each disk in the percent series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name, the students will input MATH. When the screen prompts for a class number, the students will input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 8. Later they will complete lesson 9.

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of the lesson. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. Two lessons are recommended for this skill.

Summary:

1. What does a percent of a number mean?
2. How can we rewrite tbe problem (50% of 100) using fractions?
3. How can we rewrite the problem (50% of 100) using decimals?
4. What is 50% of 100?
5. What is 14% of 234?

Homework:

See attached homework sheet.

Enrichment:

Using decimals solve:

1) 14% of 248 =

2) 14% of 2.48 =

3) 14% of 24.8 =

4) 14% of 0.248 =

Homework Sheet

Finding percentages of whole numbers

Fill in the answers:

1) 15% of 100 =
2) 25% of 200 =
3) 100% of 100 =
4) 5% of 100 =
5) 20% of 100 =
6) 1% of 100 =
7) 20% of 300 =
8) 4% of 200 =
9) 100% of 300 =
10) 5% of 1000 =
11) 6% of 250 =
12) 10% of 357 =
13) 35% of 100 =
14) 35% of 350 =
15) 42% of 100 =
16) 42% of 200 =
17) 99% of 100 =
18) 99% of 500 =
19) 50% of 200 =
20) 42% of 200 =
21) 25% of 100 =
22) 22% of 500 =
23) 25% of 44 =
24) 16% of 350 =
24) 1% of 1000 =
26) 17% of 200 =
27) 2% of 100 =
28) 20% of 50 =
29) 25% of 252 =
30) 20% of 255 =

Brain Teaser: TRUE OR FALSE?

2% of 100 = 1% of 200

TOPIC 80: Percent: Finding Interest for One Year

Aim: How can we tell how much money the bank will pay us in interest in one year.

Performance Objectives: Students will be able to:

. calculate the simple interest payable in one year
. calculate how much money will grow to in one year

Materials:

. Apple computer lab (color monitors)
. software: Math Sequences by Milliken Publishing Co.

Motivation:

Write the following on the chalkboard:

My bank will pay me 6% interest in one year. If I keep $1,000.00 in the bank for one year, how much interest will I receive? What will my account grow to?

Development:

1. After the motivation, introduce the formula I = P x R (where I is the interest paid; P is the starting amount; and R is the interest rate). Show that after one year the money is no longer just P but P + I.

2. Tell the students that the program they are about to use will teach them how to find the interest paid to them by banks.

3. Prior to bringing the class into the computer lab, the teacher must place the class on the disk. Load the disk. Where the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen prompts CLASS NAME? again select MATH. Then the screen prompts PASSWORD; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B RETURN TO TITLE PAGE. This must be done for each disk in the percent series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts the name; the students will input MATH. When the screen prompts for a class number, the student input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be

preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing onto the system, tell the students to select option C, REVIEW SYSTEM AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 13 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After the 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. Two lessons are recommended for this skill.

Summary:

1. What does the interest paid by banks mean?
2. What is the interest on $600.00 at 4% for one year?
3. What will $1,000.00 grow to in one year at 7%?

Homework:

See attached homework sheet.

Enrichment:

I keep money ($2,000.00) in a bank for two years. The bank pays 5% interest every year at the end of each year. After two years how much money will I have?

HOMEWORK SHEET

Interest for one year

Part One: Fill in the chart with the interest payable after one year.

Amount	At 5%	At 6%	At 7%	At 10%
$100.00				
$200.00				
$500.00				
$3,000.00				
$5.00				
$1.00				

Part Two: Fill in the chart with interest payable after one year, and how much the money will grow to in one year.

Starting Amount	5% Interest Payable	Total Amount
$100.00		
$200.00		
$500.00		
$1.00		
$5.00		
$1,000.00		

TOPIC 81: Changing a Decimal to a Percent and a Percent to a Decimal

Aim: How can we change a decimal into a percent and change a percent into a decimal?

Performance Objectives: Students will be able to:

- convert a decimal (less than 1) to a percent
- convert a whole number percent to a decimal

Materials:

- Apple computer lab (color monitors)
- software: Revised Math Sequences by Milliken Publishing Co.

Motivation: Write the following on the chalkboard:

Is it possible to change a decimal, 0.90 to a percent?
Is it possible to change 90% to a decimal?
What do we know about fractions that could help?

$\frac{47}{100} = 47\ \%$ $\qquad\qquad$ $\frac{47}{100} = 0.47$

If both 47% and 0.47 equal the same thing, then what does that tell you about 47% and 0.47?

Development:

1. After the motivation, do a number of problems showing a fraction having a denominator of 100 changed to a percent. Then do the reverse process. Next demonstrate a fraction having the denominator 100 changed to a decimal. Do the reverse process. Demonstrate that it is possible to go directly from a decimal to a percent. Demonstrate that the reverse process is also true.

2. Tell the students that the program they are about to use will teach them how to change decimals to percents and percents to decimals.

3. Prior to bringing the class into the computer lab, the teacher must place the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A - ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD?. Use MATH for the teacher's name. The screen then prompts CLASS NAME; again select MATH. Then the screen prompts PASSWORD; again select MATH (the screen displays xxxxxxxxxx).

5. Finally select option B - RETURN TO TITLE PAGE. This must be done for each disk in the percent series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. And when the screen prompts for a password, the students will input MATH.

8. Ideally each student has a computer. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C - REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 2 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic display congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One session is adequate for this skill.

Summary:

1. How can we change a percent to a decimal?
2. How can we change a decimal to a percent?

Homework:

Changing decimals to percents; changing percents to decimals

Part One: Fill in the missing percents

1) 0.45 = ____ %   2) 0.02 = ____ %   3) 0.68 = ____ %

2) 0.56 = ____ %   5) 0.20 = ____ %   6) 1.00 = ____ %

7) 0.13 = ____ %   8) 0.60 = ____ %   9) 0 36 = ____ %

Part Two: Fill in missing decimals

1) $\frac{37}{100}$ =

2) $\frac{93}{100}$ =

3) $\frac{65}{100}$ =

4) $\frac{3}{100}$ =

5) $\frac{17}{100}$ =

6) $\frac{9}{100}$ =

7) $\frac{99}{100}$ =

8) $\frac{41}{100}$ =

9) $\frac{71}{100}$ =

TOPIC 82: Converting Percents to Fractions

Aim: How can a number which is expressed as a percent be changed into a fraction?

Performance Objectives: Students will be able to:

- explain how percent is a fraction of 100
- identify a numerator and denominator
- determine common factors
- perform cancellation of common factors
- multiply fractions
- convert mixed numerals to improper fractions
- convert whole number percentages to fractions
- convert mixed number percentages into improper fractions
- reduce fractions to lowest terms

Materials:

- MS DOS computer lab
- software: Basic Math Competency Skill Building Converting Fractions and Percents; Problems with "Percents" by Educational Activities Inc. (also available for Apple and Commodore computers)

Motivation:

50% of Mrs. Smith's class received an "A" on their reports.
50% can also be expressed another way, as a fraction.
How can this be done?

Development:

1. Basic fraction identification is reviewed--what is a numerator? a denominator? This will be necessary for answering questions during computer time; students will be asked to type the numerator, then the denominator.

2. Review reduction of fractions to lowest terms. Review common factors and cancellation using common factors. This knowledge is vital to proper understanding of converting whole number percents to fractions, as the computer assumes this knowledge.

3. Using the problem from Motivation, students will be shown how 50% is converted to $\frac{1}{2}$. Students should already know that $50\% = \frac{1}{2}$. This knowledge will provide the students with a predictable outcome to a new procedure.

4. The idea that % (percent) means "out of 100" is introduced. From this it is demonstrated that 50% = 50 out of 100 = $\frac{50}{100}$
   $\frac{50}{100} = \frac{1}{2}$ (reduced to lowest terms)
   predicted outcome of $\frac{1}{2}$ = conversion of 50% to $\frac{1}{2}$

5. Have students load disk into the disk drive and turn on the computer The program is self-loading.

6. The computer asks for the student's name. Student may type first name, and ENTER, then last name, and ENTER.

7. The disk contains three subtopics:
   #1 Converting Percents into Fractions
   #2 Converting Fractions to Percents
   #3 Problems with Percents
   When the list appears, have students type 1 and press ENTER.

8. Students will see problems similar to those demonstrated by the teacher at the beginning of the period.

9. Students will review the first problem together, reviewing proper procedures in using the computer. Students will do subsequent problems on their own. Students will be instructed to stop when the computer begins problems with mixed number percents.

10. Students and teacher will review problems presented by computer to ensure understanding.

11. Review of multiplication of fractions.

12. Using Motivation problem from class: Suppose $52\frac{1}{2}\%$ of Mrs. Smith's class received an "A" on their book reports (if that is possible). How could $52\frac{1}{2}\%$ be expressed as a fraction?

13. Procedure is outlined:

    $52\frac{1}{2} = \frac{105}{2}$ -- converting mixed numeral into improper fractions.

    $\frac{105}{2} \times \frac{1}{100} = \frac{\overset{21}{\cancel{105}}}{2} \times \frac{1}{\underset{20}{\cancel{100}}} = \frac{21}{40}$ --> a. cancellation using common factors
    b. multiplication of fractions

    Teacher will review a second problem.

14. Students return to the computer and perform the necessary procedures for solving sample problems in mixed number percents. Teacher will be available for assistance.

15. Time permitting, students may take the quiz at the end of all sample problems. The quiz combines problems for converting whole number percents and mixed number percents. Student will receive immediate feedback as to whether a right or wrong answer has been given. The computer will score the number of right answers and an appropriate reward or warning will be presented to the student (an airplane flies across the screen with appropriate message of perfect, excellent, good or no airplane for poor performance).

16. Students will be shown how to exit the program, unload the software and turn the computer off.

Summary:

1. How can whole number percents be changed to fractions?
2. How can mixed number percents be changed to fractions?

Homework:

Appropriate homework can be assigned from the math textbook or there can be an assignment consisting of teacher-generated questions such as:

Write as fractions reduced to lowest terms:

a) 20%   b) 87 1/2%   c) 40%   d) 83 1/3%

TOPIC 83: Converting Fractions to Percents

Aim: How can a number which is expressed as a fraction be changed to a percent?

Performance Objectives: Students will be able to:

- explain the concept of percent as a fraction of 100
- identify a numerator and denominator
- determine common factors
- convert a fraction to a percent

Materials:

- MS DOS computer lab
- software: Basic Math Competency Skill Building Converting Fractions and Percents; Problems with "Percents" by Educational Activities Inc. (also available for Apple and Commodore computers)

Motivation:

$\frac{1}{4}$ of Mrs. Smith's class will not go on the next class trip. How can we express $\frac{1}{4}$ as a percent? (Hint: percent means hundredths.)

Development:

1. Review numerator, denominator, common factors. This knowledge will be necessary for successful use of the software.

2. Discussion of the Motivation: Students will be shown that 1/4 = 25% (Students will either have this knowledge or it may be demonstrated by the teacher.)
   e.g. 4 parts = 1 whole
   1 whole = $\frac{100}{100}$ = 100%
   $\frac{1}{4} = \frac{25}{100}$
   $\frac{1}{4}$ = 25%

   predicted outcome of 25% = conversion of $\frac{1}{4}$ to 25%

3. Have students load disk into disk drive and turn on the monitor and computer. The program is self-loading.

4. Have students type their first names and press ENTER, then their last names and ENTER.

5. When the list of subtopics appears, have students type 2 and press ENTER.

6. Students will view sample problems for converting fractions to percents where the fraction's denominator is a factor of 100. The first problem will be done by the class together to establish proper computer usage.

7. Students will stop at the point where the sample problems demonstrate how to convert a fraction whose denominator is not a factor of 100.

8. Using the Motivation: Suppose $\frac{1}{6}$ of Mrs. Smith's class did not go the next class trip. How could we change $\frac{1}{6}$ to a percent?

   Review cross multiplication and solving for a unknown.

   $\frac{1}{6} = \frac{N}{100}$

   $6N = 100$

   $N = 100 \quad 6$

   $N = 16\frac{4}{6} = 16\frac{2}{3}$

9. Students will review sample problems where they must set up an appropriate proportion and solve for the unknown.

10. Students may continue and take the quiz for review of material. The computer will tell the student whether the student's answer is right or wrong, but will not provide an explanation of a mistake.

11. When the student is finished with the quiz, the computer will compute the number of correct answers. An appropriate reward (an airplane flies across the screen with the message of perfect, excellent, good) or warning of the need for improvement is provided.

12. Students should return quizzes to the teacher so that they may be evaluated for instructional needs. Students should show all work on the quizzes.

13. If time permits, the student should be permitted to review any of the sample problems that the student wishes to review.

14. Have students remove disks, turn off computers and monitors and return disks to protective covers.

Summary:

1. How can a fraction whose denominator is a factor of 100 be changed to a percent?
2. How can a fraction whose denominator is not a factor of 100 be changed to a percent?

Homework:

Assignment of appropriate math text pages.

Rexograph of teacher made questions:

$\frac{1}{10} = N \qquad \frac{1}{7} = N$

$\frac{1}{50} = N \qquad \frac{2}{6} = N$

TOPIC 84: Finding the Order of Two Different Percents

Aim: How can we tell which percent is larger than the other?

Performance Objectives: Students will be able to:

- find the largest percent in a list of percents
- find the smallest percent in a group of various percents
- solve problems using < and >

Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.

Motivation:

Write the following on the chalkboard:

Look at the following numbers 35, 37, 78, 130
Which number is the greatest? Which is the least?
Look at the following percents .... 35%, 37%, 78%, 130%.
Which percent is the greatest? Which is the least?

Development:

1. After the motivation, do a number of problems showing greatest and least of a group of numbers and a group of percents.

2. Tell the students that the program they are about to use will teach them how to find the greatest and least percents.

3. Prior to bringing the class into the computer lab, the teacher must place the class on the disk. Load the disk. When the Title Page appears, hold the CONTROL key down and press the I key.

4. Select option A - ADD A CLASS. The screen prompts: NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME?; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

5. Finally select option B - RETURN TO TITLE PAGE. This must be done for each disk in the percent series. It need only be done once.

6. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

7. When the Title Page appears, tell the students to press the RETURN key. The screen prompts for a name, the students will input MATH. When the screen prompts for a class number, the students will input 1. When the screen prompts for a password, the students will input MATH.

8. Ideally there should be a computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended

8. Ideally each student has a computer. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign into the system, as a teacher (review #7), and work on one skill area only. The system will not retain records of the work.

9. After signing into the system, tell the students to select option C - REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 2 (which corresponds to today's lesson).

10. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic display congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

11. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

12. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

13. One session is adequate for this skill.

Summary:

1. How can we change a percent to a decimal?
2. How can we change a decimal to a percent?

Homework:

Changing decimals to percents; changing percents to decimals

Part One: Fill in the missing percents

1) 0.45 = ____ %   2) 0.02 = ____ %   3) 0.68 = ____ %

2) 0.56 = ____ %   5) 0.20 = ____ %   6) 1.00 = ____ %

7) 0.13 = ____ %   8) 0.60 = ____ %   9) 0 36 = ____ %

Part Two: Fill in missing decimals

1) $\frac{37}{100}$ =   2) $\frac{93}{100}$ =   3) $\frac{65}{100}$ =

4) $\frac{3}{100}$ =   5) $\frac{17}{100}$ =   6) $\frac{9}{100}$ =

Homework Sheet

Finding the order to different percents

Part One Circle the largest percent

1) 35.7%, 40.01%, 74.23%, 23.67%, 0.23%

2) 23.5%, 30.21% , 13.56% , 12.3445%

3) 23.456%, 23.457% , 23.465%

Part Two Circle the smallest percent

1) 23. 4% , 45.29% , 120.5% , 0.23%

2) 23.456%, 23.467% , 23.423% , 23.103%

3) 2.76% , 27.6% , 0.276%

Part Three Fill in the missing sign (> , = , <)

1)	23.56%	23.65%	2)	12.4	12.42	3)	12.4%	12.4
4)	12%	0.12	5)	14.5%	0.145	6)	25.0%	25.0
7)	$\frac{1}{5}$	0.20	8)	20%	0.20	9)	16.3	0.00163
10)	99.9	$\frac{1}{3}$	11)	25%	$\frac{1}{4}$	12)	32.9	3.29%
13)	32.9%	3.29						

PART VIII

Geometry

TOPIC 85: Constructing Circles Using Geometry

Aim: How do you construct circles using geometry?

Performance Objectives: Students will be able to:

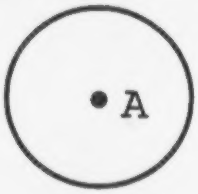
- identify center point and radius as information needed for constructing circles
- draw several circles of different sizes
- describe a procedure for duplicating a given circle

Materials:

- Apple II computer with 64k
- software: The Geometric PreSupposer by Sunburst Communications
- chalkboard, chalk, string (ruler, compass - optional)

Motivation:

With chalk and string, have students watch as you draw a circle on the chalkboard. Label a center point with a dot and a capital letter.



Tell students they will have the computer draw a circle, and that the computer will need two pieces of information to do so. Ask class what they think these two elements will be.

Development:

1. Challenge students to describe what two pieces of information the computer needs to draw a circle. If center point, and distance to edge (i.e. radius) are not suggested, draw a radius on circle on the board and label it AB. Remind students that in order to draw a circle, you need a center point (A) and a radius.

2. Tell students that the program they are about to use will allow them to draw circles of different sizes, and in different places to make their own patterns.

3. Review correct handling of disks. Tell students to insert disk into drive A, turn on monitor and computer power. The program is self loading.

4. After the Sunburst logo and title screens, the first menu appears. Tell students to press N for NEW SHAPE. Remind students they must tell the computer the center point for a circle and should select 1 for POINT. If students make mistakes at any time they should press ESCAPE to go back. A point will appear on the screen. Instruct students that they may use letters DRFC or arrow keys to move the point. They may change the size of the steps the point moves by pressing S when they have decided where they want the center point to be and then press RETURN. The computer will label the center point A.

5. On the next menu, students should choose 1 for DRAW. Next choose 2 for CIRCLE. Then choose 3 for OTHER. When instructions ask for center of circle, remind students that the name of this center point is A. Type A and RETURN. On the next menu, choose 2 for New Point.

6. Students will use letter or arrow keys to position point B. Call students' attention to the letters AB= in the lower left corner of the screen and how the numerals change as the new point (B) is moved. Tell them that this shows the distance between points A and B - the radius length. Press RETURN when ready. Computer will draw the circle.

7. Have students experiment with drawing different size circles. They may start anew each time by pressing ESCAPE, N, and 1, or they may draw several circles on the screen by pressing 2, 3, and a letter key. Allow students about 15 minutes to practice the sequence of steps for drawing different sizes and patterns of circles.

8. Discuss the kinds of patterns created, as they appear (e.g., concentric circles - such as a bull's eye or target; circles whose edges touch - are tangent, etc.).

9. Instruct students to remove disks, turn off computer and monitor, and to put diskette into their protective covers.

Summary:

1. What two pieces of information are needed in order to draw a circle?
2. What items can you use for drawing circles without a computer? (Pencil, string, or compass, paper)
3. What happens when you make the radius smaller? larger?
4. What steps would you follow to draw two separate circles of exactly the same size?

Homework:

1. Draw a pattern of circles on a piece of paper.

2. If you know the size of a radius, what can you do to find the distance all the way across a circle? (diameter)

3. List three different things you use every day that depend on circles to work. (clock, machines with gears, knobs, vehicles, jars/bottles with screw on lids, etc.)

Enrichment:

1. Devise a way to measure the distance around a circle. (circumference)
2. Devise a way to measure the area of a circle.

TOPIC 86: Proving Symmetry

Aim: How do you prove that something has symmetry?

Performance Objectives: Students will be able to:

- define symmetry using terms such as same, identical, half, balance, etc.
- identify pictures which are symmetrical
- create pictures or designs which are symmetrical
- name, construct, or recognize three-dimensional objects which are symmetrical
- prove by statement or demonstration that a picture or object is symmetrical

Materials:

- Apple II computer (II+, IIe, IIc)
- software: The Math Professor #2861 - Symmetry by Bergwall Educational Software, Inc.
- a symmetrical drawing or design
- graph paper, construction paper, markers, scissors, small mirror

Motivation:

Display a drawing. Ask students what they notice about the picture. If students do not notice that there is a repeated pattern, draw the line of symmetry and have students discuss what they see.

Development:

1. Tell students they will be using a program which will help them practice recognizing pictures which have symmetry and pictures which do not.

2. Review correct handling of disks. Tell students to insert disk into drive A, turn on monitor and computer power. The program is self loading.

3. Each screen has instructions so that students may work independently. Some students may be prompted if they have trouble locating or following the on-screen instructions. Students will type their first name, then wait for the next screen. Tell students to follow the on-screen instructions.

4. After ten sets of pictures are shown, student's score is displayed. Students may play again (pictures will be different and/or in a different order). Allow students time to play two or three games; about 10 to 15 minutes.

5. Tell students to remove disks, turn off computers and monitors and put diskettes into their protective covers.

6. Tell students you will show them two ways to make their own symmetrical design. Take a piece of construction paper and fold it in half. Use scissors to cut a design, being careful not to cut through the fold. Open the paper and look at the design. Ask students: Is the design symmetrical? How can this be proven?

   Use a piece of graph paper. Draw a vertical or horizontal line through the middle of the paper with a marker. Use a marker to color some squares on one side of the line. Color corresponding squares on other side of the line. Ask: Is this design symmetrical? How can this be shown? Prove that the design is symmetrical by holding a mirror against the middle line and noting that the design is reflected or by folding the design in half and noting that the two halves are the same.

Summary:

1. What is symmetry?
2. How can you prove that a picture has symmetry? (fold picture, draw a line, use a mirror).

Homework:

Draw and/or cut out a picture or design that has symmetry. Prove that the design is symmetrical.

Enrichment:

1. Can three-dimensional objects be symmetrical? Prove your answer.

2. Is the human face symmetrical? Are natural objects symmetrical? Prove your answer.

3. Write a symmetrical number or word (i.e. palindrome).

PART IX

Signed Numbers

TOPIC 87: Comparing Integers

Aim: How do we compare numbers?

Performance Objectives: Students will be able to:

- compare two single-digit integers using > and <
- describe use of one-to-one correspondence to "prove" an answer
- compare two two-digit integers using > and <
- describe comparison of tens and ones digits to "prove" answer
- compare two three-digit integers using > and <
- describe comparing hundreds digits, tens digits, and ones digits to find answer

Materials:

- Apple II with 64K (color recommended but not required)
- software: The New Arithmetic Classroom, Second Edition, Number Ideas 100 to 999 by D.C. Heath
  for Enrichment: Inequalities by Bergwall Educational Software
  Comparing Numbers I and Comparing Numbers II by Centurion Industries, Inc.

Motivation:

Write two very large numbers next to each other on the board, leaving a space between them. Draw a rectangle between the two numbers:
e.g., 8654397217 86521994999

Tell students they will learn a method for deciding which of the numbers shown is less and which is greater.

Development:

1. Explain to students they will use a program which will show how to compare numbers and that they will begin with small numbers, then learn how to decide about longer numbers with more digits or places.

2. Write the > and < signs on the board and label them "greater than" and "less than." Tell students these are signs we use to compare numbers. Have students locate the signs on the computer keyboard. Now have students insert diskette into drive A, and turn on monitor and computer power. The program is self-loading. Tell students they will see a little computer figure - his name is Micro. Micro will teach them about comparing numbers. Remind students to press RETURN when they see these words at the bottom of the screen. Press RETURN again. Students should type their name and press RETURN. Type 2 (to choose lesson 2 - Order) and press RETURN. Wait for lesson to load, keep looking for the PRESS RETURN message. Remind students that if nothing happens, press RETURN. To type the > and < signs, students will have to hold down the Shift key while pressing > or < key. After the lesson, there is a practice (8 examples) and a display of score. Program is self-teaching and gives students corrective feedback when they make a mistake. Tell students they may practice at the same level until they feel comfortable, then may go to the next level (e.g., two-digit numbers; three-digit numbers). After 20 to 25 minutes, tell students to remove disk, turn off the computer, and put diskettes into their protective covers.

Summary:

1. What does this sign mean: >?
2. What does this sign mean: <?
3. What are the steps you take to decide which of two numbers is greater, which is less? (Examine digits in each place, beginning on the left.)

Homework:

Distribute attached worksheet.

Enrichment:

1. Explain how to decide which of the two numbers written on the board at the beginning of the lesson is greater. Which sign belongs in the box between them?

2. Use the following computer programs to extend the concepts of > and < to include the = sign and for comparing number sentences:

   - Inequalities by Bergwall Educational Software
   - Comparing Numbers I and Comparing Numbers II by Centurion Industries, Inc.

HOMEWORK

NAME:

Directions: Write > or < in the box to make the statement true.

1. 7 ☐ 8
2. 4 ☐ 2
3. 6 ☐ 9
4. 3 ☐ 5
5. 9 ☐ 8
6. 1 ☐ 0
7. 2 ☐ 7
8. 5 ☐ 1
9. 0 ☐ 6
10. 8 ☐ 3
11. 2 ☐ 6
12. 58 ☐ 12
13. 29 ☐ 47
14. 32 ☐ 30
15. 65 ☐ 94
16. 88 ☐ 87
17. 75 ☐ 26
18. 19 ☐ 39
19. 98 ☐ 92
20. 40 ☐ 10
21. 82 ☐ 85
22. 52 ☐ 50
23. 127 ☐ 721
24. 943 ☐ 946
25. 807 ☐ 801
26. 549 ☐ 546
27. 723 ☐ 823
28. 450 ☐ 452
29. 600 ☐ 599
30. 254 ☐ 632
31. 371 ☐ 671
32. 108 ☐ 104
33. 520 ☐ 516

TOPIC 88: Adding Integers

Aim: How is the sum of two signed numbers found?

Performance Objectives: Students will be able to,

- identify an integer
- explain absolute value in relation to integers
- name the opposite of an integer
- add two positive integers
- add two negative integers
- add a positive and a negative integer

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra, by Softwriters Development Corporation

Motivation:

Put on the chalkboard the following list and ask students to copy it and write the opposite for each item,

up
to the left
forward
inside
5 spaces to the left

3 steps up
gain of 12
+6
-3
7

Also draw a number line as follows,

```
<-|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-->
  -9 -8 -7 -6 -5 -4 -3 -2 -1  0  1  2  3  4  5  6  7  8  9
```

Allow students several minutes to copy and complete the table. How do we indicate numbers to the right on a number line? How do we indicate numbers to the left on a number line? What does the absolute value of a number show on a number line? (distance from zero)
Have students show movement on a number line (i.e. 3 to the right, 5 to the left) Agree that "to the right" will be indicated by a positive number, "to the left" by a negative number.

Development:

1. Use the number line to indicate combined movements; 3 to the right, followed by 4 more to the right. Have a student show the movement and give the result using the number line. Write the corresponding addition fact, (+3) + (+4) = 7 or 3 + 4 = 7. Agree that 3 = +3, 4 = +4, etc. Have students show at the board the following movements and addition facts:
   3 to the right, followed by 7 to the left: 3 + (-7) = -4
   7 to the right, followed by 3 to the left: 7 + (-3) = 4
   4 to the left, followed by 3 to the left: (-4) + (-3) = -7

2. Tell students the program they are about to use will review the meaning of integers, opposites and absolute value and show them how to use these concepts to add integers.

3. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise, have disk 4 ready to replace disk 1 when the program indicates.

4. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson: press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #11, and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #11 to appear.

5. First some examples of integers and their absolute values will be given. Then the meaning of absolute value with regard to a number line will be explained and a four-question quiz given. The student will then be given a raw score and percent correct. At this point the student should be sure that disk 1 is in drive 1 and press RETURN to select a new lesson.

6. When the lesson number grid reappears, the student should use directional arrows to select lesson #12 and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #12 to appear.

7. First some completed examples of addition and subtraction of integers will be shown. The student will be shown how to add integers with like signs using absolute values, how to add integers with unlike signs and that subtraction can be changed to addition with opposites. The lesson is followed by an eight-question quiz and ends with the student's raw score and percent correct.

8. Allow the students about 15 minutes to complete the two lessons. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

Summary:

1. What is an integer?
2. How is the absolute value of an integer determined?
3. What does the absolute value of an integer mean with regard to a number line?
4. How is the numeral for the sum of two positive integers found? What is the sign of the sum?
5. How is the numeral for the sum of two negative integers found? What is the sign of the sum?
6. How is the numeral for the sum of a positive and a negative integer found? How is the sign determined?

Homework:

Prepare a rexographed sheet with addition examples involving various combinations of positive and negative integers or make an appropriate assignment from the student text.

Enrichment:

Have students generate an addition table for sums of integers from 10 + 10 through (-10) + (-10).

TOPIC 89: Subtracting Integers

Aim: How is the difference of two signed numbers found?

Performance Objectives: Students will be able to:

- subtract two positive integers
- subtract two negative integers
- subtract a positive integer from a negative integer
- subtract a negative integer from a positive integer

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra, by Softwriters Development Corporation

Motivation:

Put the following on the chalkboard:
Addition fact - Related subtraction facts

3 + 4 = 7	7 - 4 = 3	7 - 3 = 4
-3 + 4 = 1	1 - 4 = -3	1 - (-3) = 4
(-3) + (-4) = -7	(-7) - (-4) = -3	(-7) - (-3) = -4

Complete: for each addition fact write two related subtraction facts,

5 + (-1) = 4;	4 - (-1) = ____	4 - 5 = ____
5 + (-8) = ____	____ - (-8) = -3	____ - 5 = ____
-3 + 7 = ____	____ - 7 = -3	____ - (-3) = 7
-9 + 3 = ____	____ - (-9) = ____	____ - (-4) = ____
-4 + (-7) = ____	____ - (-7) = ____	____ - (-4) = ____
-8 + (-3) = ____	____ - (-8) = ____	____ - (-3) = ____

Allow students about five minutes to complete the tables. How is subtraction the opposite of addition?
What addition example would give the same answer as the subtraction? How are the numbers related?

Development:

1. Next to the first six completed subtraction examples on the board write addition examples using opposites; have students supply answers.

7 - 4 = 3	7 + (-4) = 3
7 - 3 = 4	7 + (-3) = 4
1 - 4 = -3	1 + (-4) = -3
1 - (-3) = 4	1 + 3 = 4
(-7) - (-4) = (-3)	-7 + 4 = -3
(-7) - (-3) = (-4)	-7 + 3 = -4

Elicit through student observation that to subtract a number it is possible to add its opposite.

2. Tell students that the program they are about to use will review the rules for adding integers and show them how to add integers by use of the method of adding opposites.

3. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise, have disk 4 ready to replace disk 1 when the program indicates.

4. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson: press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #12, and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #12 to appear.

5. First the program will show some completed examples of addition and subtraction of integers, review rules of addition and show how to change subtraction examples to addition. Practice will be provided by means of an eight-question quiz which will be followed by the raw score and percent correct.

6. Allow students about ten minutes to complete the lesson. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

7. Optional: For more advanced students, give practice in subtraction of integers by the missing addend method:

7 - 4 = ?	? + 4 = 7	3 + 4 = 7
-7 - 4 = ?	? + 4 = -7	-11 + 4 = -7
7 - (-4) = ?	? + (-4) = 7	11 + (-4) = 7
-7 - (-3) = ?	? + (-4) = (-7)	-3 + (-4) = -7

Summary:

1. How is the opposite of an integer found?
2. What is the relationship between subtraction and addition?
3. How is the opposite of an integer used in subtraction?
4. How is a subtraction example changed to a related addition example which results in the same answer?

Homework:

Prepare a rexographed fill-in sheet of subtraction examples with a space for students to rewrite them as addition of opposites and a blank for the answer, or make an appropriate assignment from the student text.

Enrichment:

Have students complete an assignment similar to the homework. Have them rewrite the subtraction examples as addition with a missing addend and then find the missing addend.

TOPIC 90: Multiplying and Dividing Integers

Aim: How are integers multiplied and divided?

Performance Objectives: Students will be able to:

- multiply integers with like signs
- multiply integers with different signs
- divide integers with like signs
- divide integers with different signs

Materials:

- Apple computer lab
- software: Mastering Beginning Geometry and Algebra by Softwriters Development Corporation

Motivation:

Put the following on the chalkboard:
Multiplication is repeated addition - Complete:

5 + 5 + 5 + 5 + 5 = 25	5 x 5 = 25
(-5) + (-5) + (-5) + (-5) + (-5) = _____	5 x (-5) = _____
9 + 9 + 9 = _____	3 x 9 = _____
(-9) + (-9) + (-9) = _____	3 x (-9) = _____

Allow students a few minutes to copy and complete the table. What is the sign of the product of two positive integers? What is the sign of the product of a positive and a negative integer? How do we find out the sign of the product of two negative integers? Suggest the study of number patterns.

Development:

1. Put the following tables on the chalkboard:

positive x (pos. to neg.)	negative x (pos. to neg.)	
6 x 3 = 18	-4 x 3 = -12	
6 x 2 = 12	-4 x 2 = -8	
6 x 1 = 6	-4 x 1 = -4	
6 x 0 = 0	-4 x 0 = 0	
6 x -1 = -6	-4 x -1 = ?	(4)
6 x -2 = -12	-4 x -2 = ?	(8)
6 x -3 = -18	-4 x -3 = ?	(12)
product decreases	product appears to increase, suggesting product of two negative numbers is positive.	

2. Use identity and distributive properties to find rule.

   6 x 0 = 0; -6 x 0 = 0; 5 + -5 = 0 substitute:
   -6 x (5 + -5) = 0
   (-6 x 5) + (-6 x -5) = 0 use distributive property
   -6 x 5 = -30 -6 x -5 = ?
   -30 + ? = 0; -30 + 30 = 0; therefore -6 x -5 = 30
   The product of two negative integers is positive.

3. Use inverse operations to show rules for dividing integers.

$6 \times 5 = 30$ $\quad$ $30 \div 5 = 6$ $\quad$ $30 \div 6 = 5$
$-6 \times 5 = -30$ $\quad$ $-30 \div -6 = 5$ $\quad$ $-30 \div 5 = -6$
$-6 \times -5 = 30$ $\quad$ $30 \div -6 = -5$ $\quad$ $30 \div -5 = -6$

4. Tell students that the program they are about to use will show them how to multiply and divide integers and give them practice in the skills.

5. Remind students of proper disk handling techniques and have them load disk 1 into drive 1. If two disk drives are available, place disk 4 in drive 2. Otherwise have disk 4 ready to replace disk 1 when the program indicates.

6. The self-loading program will first ask if you wish to keep previous scores. Press 2 to erase scores. Then there will be a choice of pretest or lesson: press 2 to select lesson. When a number grid appears, use directional arrows to highlight lesson #13, and press RETURN. Follow appropriate directions to load disk 4 and wait for lesson #13 to appear.

7. First, several completed multiplication and division examples will be shown. Then the rules will be given for multiplying and dividing integers with the same sign, followed by the rules for multiplying and dividing integers with different signs. Practice will be given in the form of an eight-question quiz. The lesson ends with the student's raw score and percent correct.

8. Allow students about ten minutes to complete the computer activity. Have students remove the disks, turn off the computer and monitor, and return the disks to their protective pockets.

Summary:

1. How is the numeral of the product of two positive integers found? What is the sign of the product?
2. How is the numeral of the product of a positive and a negative integer found? What is the sign of the product?
3. How is the numeral of the product of two negative integers found? What is the sign of the product?
4. What is the rule for the sign of the product of two integers?
5. What is the rule for the sign of the quotient of two integers?
6. How are the rules for dividing integers related to those for multiplication?

Homework,

Prepare a rexographed fill-in sheet of 10-15 multiplication examples and 10-15 division examples using various combinations of integers including some multiplication examples containing zero, or make an appropriate assignment from the student text.

Enrichment:

Have students prepare a multiplication table for products from 6 x 6 through -6 x -6 and a corresponding division table using the products and the integers 6 through -6.

PART X

Measurement

TOPIC 91: Converting Inches to Feet

Aim: How can we convert inches to feet?

Performance Objectives: Students will be able to:

- use addition and subtraction to determine lengths
- read standard measurements
- convert inches to feet
- demonstrate a strategy for determining the difference between measurements with feet and inches

Materials:

- Apple IIe lab
- software: Math Shop by Scholastic
- Cuisenaire rods
- standard 12 in. rulers
- tape measure

Motivation:

Display two Cuisenaire rods of different lengths. Ask students to describe what they see. Use leading questions to get students to describe the length of the objects in rods (i.e. six green rods are equal to one red rod). Have a student use a standard ruler to measure the pieces in inches. Another student should write the measurements on the chalkboard. Repeat this activity with more Cuisenaire rods.

Development:

1. Review the measurements for inches and feet.

   12 inches = 1 foot
   24 inches = 2 feet
   36 inches = 3 feet

2. Have students find objects in the classroom that have the following measurements. Students should record their information in chart form.

OBJECT	MEASURE
looseleaf paper	11 inches or 11"
	4 feet or 4'
chalk	4 inches or 4"
	5 feet or 5'

3. Compare these measures. The looseleaf paper is how many inches more than the chalk? Which object is 1 foot less than the other?

4. Use the tape measure to determine the difference between larger objects in the classroom (i.e. chalkboard, length of the closet doors, long side of the classroom, short side of the classroom). Have students set up a work table for the measurements that include feet and inches.

Object	MEASUREMENT
1. long side of chalkboard	_____feet _____inches
2. short side of chalkboard	_____feet _____inches
Difference	_____feet _____inches

5. Provide exercises for students to subtract and add feet and inches.
   i.e. 10' 5" 18' 4"
   - 5' 7" + 10' 3"

6. Tell students to develop a strategy for solving the measurement problems given in the Math Shop program and be ready to share it with the class.

7. Students are to boot up the program and wait for the menu to appear. Press "0" to open one shop and start working on the problems.

8. Advise students to use paper and pencil to calculate the answers. Provide at least fifteen to twenty minutes for computer use.

9. After using the computer program, students should discuss the strategy or strategies they used to obtain their answers.

Summary:

1. What is the equivalent length in feet for the following dimensions?
   a. 8 ft. 16 in. b. 12 ft. 20 in. c. 16 in.

2. What is the difference between the measurements below? a.
   a. 10' 7" b. 5' 5" c. 12' 3"
   - 9'10" - 3' 2" - 9' 7"

3. What operations are needed to convert inches to feet?

Homework:

1. Complete the chart below.

Length of Wood	A	B	C	D	E	F	G
Wood Piece K	11						
Wood Piece L	7						
Length of K and L	18	12	34	10	8 $\frac{1}{2}$	22'0"	18'4"
Length of K less length of L	4	2	8	6	4	0'0"	1'4"

Enrichment:

Computer Activity: Work in the "Lumber Shop" with the clock. Students are to serve as many customers as possible within an allotted time period.

Off Computer: Students are to complete the problems based on the homework chart.

1. If K + L = 22 and K - L = 6, what is the value of K and what is the value of L?
2. If L is 2 more than K and K + L = 16, what is the value of K? of L?
3. If L is 14 and K is 2, what is the total length?

TOPIC 92: Finding the Perimeter of a Polygon

Aim: How do we find the perimeter of a polygon?

Performance Objectives: Students will be able to:

- define perimeter
- identify the sides of a polygon
- find the perimeter of a polygon

Materials:

- Apple IIe or IIc, single disk drive, color or monochrome monitor
- software: Bergwall Educational Software Inc: The Math Professor: Perimeter Disk

Motivation:

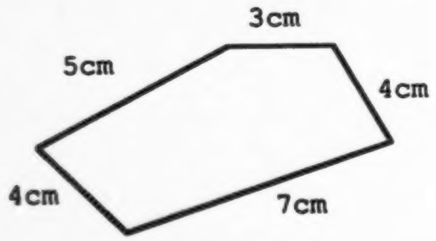
The Athletic Club would like to put a fence around their soccer field. The dimensions of the field are 100 feet by 65 by 97 feet by 70 feet. How much fencing will be needed to enclose the field?

Development:

1. Elicit the definition of perimeter of a polygon
   Definition: perimeter is the measure of the distance around a polygon.

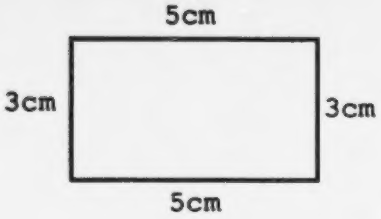
2. Elicit from the students the solution to the Motivation.
   a) What type of polygon is it? (quadrilateral)
      Discuss definition of quadrilateral
   b) What is the measure of each side of this polygon?
      (100 feet, 65 feet, 97 feet, 70 feet)
   c) What is the measure of the distance around this polygon?
      (100 + 65 + 97 + 70 = 332 feet)

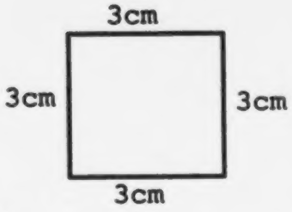
3. Display this diagram on the chalkboard.



4. Elicit the answers to these questions:
   a) What type of polygon is it? (pentagon) Discuss definition of pentagon
   b) What is the measure of each side of this polygon?
      (5cm, 3cm, 4cm, 7cm, 4cm)
   c) What is the measure of the distance around this polygon?
      (5 + 3 + 4 + 7 + 4= 23cm)

5. Guide students through these two problems. Ask the students questions as presented in Development # 4.





Note: leave shortcuts for a second lesson

6. Tell the students that the program they are about to use will teach them how to find the perimeter of different types of polygons.

7. This program presents a lesson. Ten examples are displayed by the "Shape Machine." A true-or-false game-type quiz poses ten additional problems. Upon completion, the student has the choice of starting over again, excluding the lesson or quitting the program.

Summary:

1. How do we define perimeter?
2. How do we identify the sides of the polygon?
3. How do we find the perimeter of a polygon?

Homework See attached Worksheet

Enrichment:

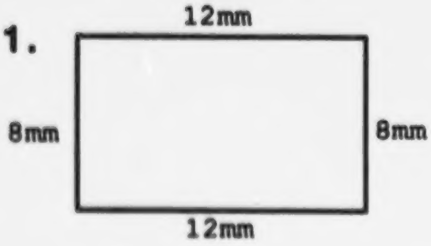
1. The perimeter of a quadrilateral is 467 feet. if three of its sides are 117 ft., 129 ft., and 88 ft., find the fourth side.

2. The perimeter of a regular decagon is 499 cm. Find the length of each side.

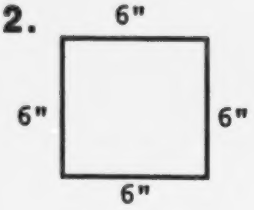
Homework Assignment

Find the perimeter of each figure:

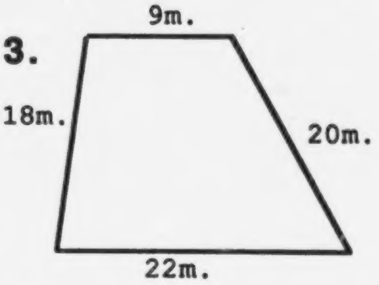
1.


12mm
8mm
8mm
12mm

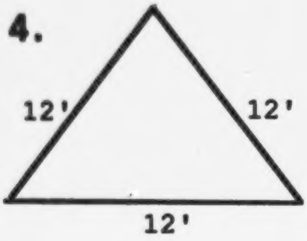
2.



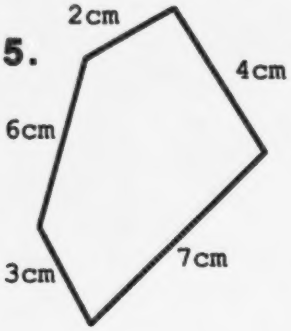
3.


9m.
18m.
20m.
22m.

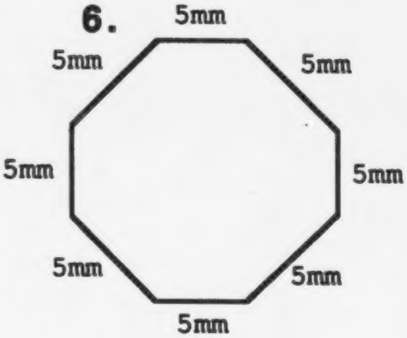
4.



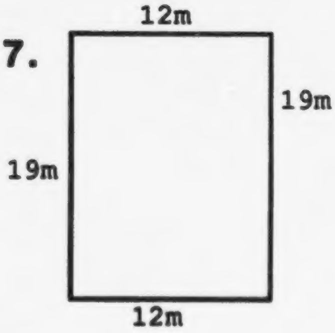
5.


2cm
4cm
6cm
3cm
7cm

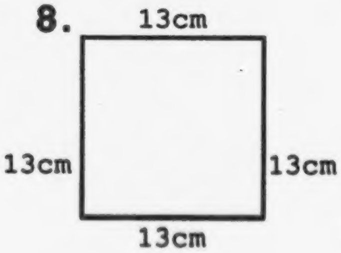
6.


5mm
5mm
5mm
5mm
5mm
5mm
5mm
5mm

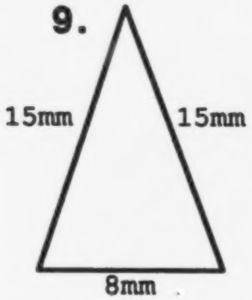
7.


12m
19m
19m
12m

8.


13cm
13cm
13cm
13cm

9.


15mm
15mm
8mm

TOPIC 93: Finding the Perimeter of a Polygon Using Shortcuts

Aim: How do we find the perimeter of a polygon using shortcuts?

Performance Objectives: Students will be able to:

- find the perimeter of a polygon
- find the perimeter of a polygon using a shortcut where applicable

Materials:

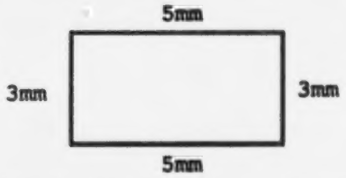
- Apple IIe or IIc, single disk, color or monochrome monitor
- software: Bergwall Educational software inc.: The Math Professor: Perimeter Disk

Motivation:

What is a faster way to compute 5 + 5 + 5 + 5 + 5?

Development:

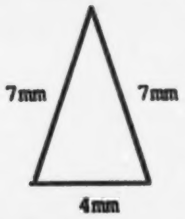
1. Display this diagram on the chalkboard. Elicit from the students the method for finding the perimeter of a polygon.
   (add the sides) (5 + 3 + 5 + 3 = 16cm)



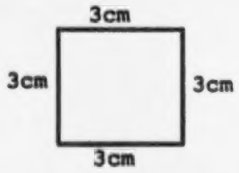
2. Elicit a shortcut for finding the perimeter of the above rectangle:
   instead of 5 + 3 + 5 + 3 = 16cm
   use 2 fives plus two threes 2 x 5 + 2 x 3 = 10 + 6 = 16cm.
   2 x (5 + 3)= 2 x 8 = 16cm

3. Guide students through these two problems using shortcuts.

a)



b)



Instead of 7 + 7 + 4 = 18, use
2 sevens plus four or 2 x 7 + 4 = 18mm

Instead of 3 + 3 + 3 + 3 = 12,
use 4 threes or 4 x 3 = 12mm

5. Tell the students that the program they are about to use will teach them to find the perimeter of different types of polygons. Tell the students to use a shortcut to find the answer if possible.

6. This program presents a lesson. Ten examples are displayed by the "Shape Machine." A true-or-false game-type quiz poses ten additional problems. Upon completion, the student has the choice of starting over again, excluding the lesson or quitting the program.

Summary:

1. How do we find the perimeter of a polygon?
2. How do we find the perimeter of a polygon using a shortcut?

Homework: See attached worksheet

Enrichment:

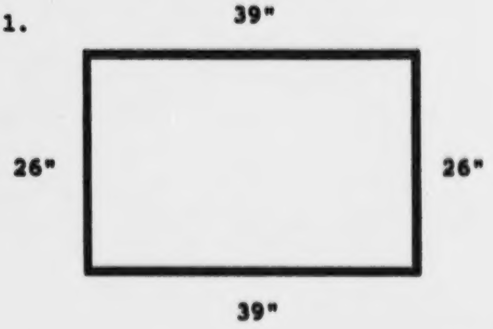
1. Find the perimeter of a regular octagon if each side is 55m.

2. Find the perimeter of a regular decagon if each side is 2965mm.

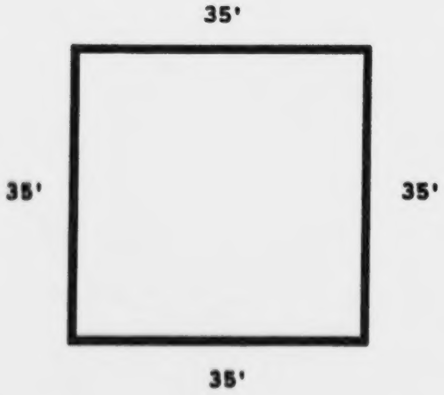
Homework Assignment

Find the perimeter of each figure. Use a shortcut if possible:

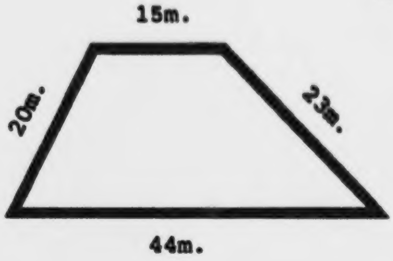
1.



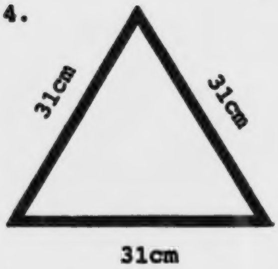
2.



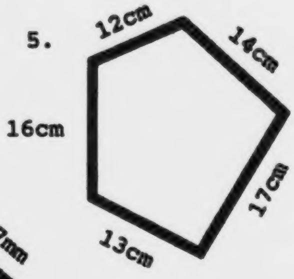
3.


15m.
20m.
23m.
44m.

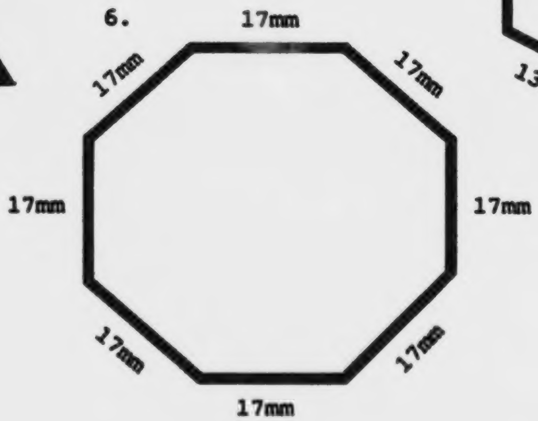
4.


31cm
31cm
31cm

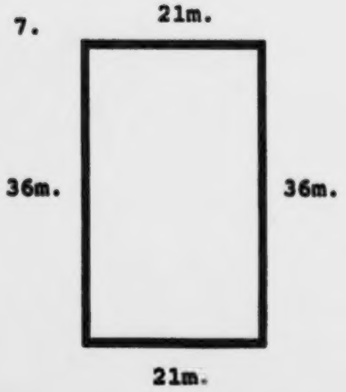
5.


12cm
14cm
16cm
17cm
13cm

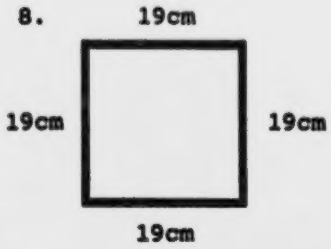
6.


17mm
17mm
17mm
17mm
17mm
17mm
17mm
17mm

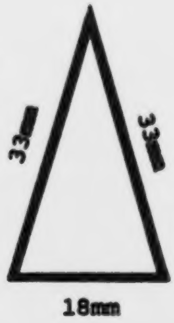
7.


21m.
36m.
36m.
21m.

8.


19cm
19cm
19cm
19cm

9.


33mm
33mm
18mm

TOPIC 94: Using a Metric Ruler

Aim: How is a metric ruler used to measure objects?

Performance Objectives: Students will be able to:

- measure various objects in centimeters and millimeters using a metric ruler
- convert a measurement in centimeters to millimeters
- convert a measurement in millimeters to centimeters

Materials:

- MS DOS computer with color monitor
- software: Metrics IV: Linear Units by Classroom Consortia Media, Inc.
- meter sticks and metric rulers

Motivation:

How long is the longest part of your desk to the nearest centimeter? How many millimeters are left over? How many millimeters are there altogether?

Development:

1. Have students load the software into the disk drive and turn on computers and monitors. When the menu appears, direct students to type 2 and press RETURN.

2. Help students perform the first series of measurement exercises using a metric ruler. Make sure students understand that answers must be expressed in centimeters and millimeters. It is suggested that the first problem be completed together. The object to be measured may be moved across the top of the ruler. Help any students who are confused by these directions.

3. After the first set of exercises, students will be asked to complete another series of exercises in which they are given a particular measurement expressed in centimeters or millimeters and are asked to use the appropriate cursor keys (<--, -->) to draw a line of the desired length.

4. After the second set of exercises, have students press ESCAPE. When the menu reappears, direct students to type 6 and press RETURN to exit.

5. Direct students to remove disks, turn off the computers and monitors, and return disks to protective sleeves.

Summary:

1. How is a metric ruler used to measure objects?
2. What metric units are use to measure objects?
3. How many millimeters are in 3 centimeters? in 3.4 centimeters?
4. Can centimeters equal 50 millimeters? 56 millimeters?

Homework:

1. Measure 10 objects in your home using a metric ruler.
2. Express the 10 measurements in both millimeters and centimeters.

Enrichment:

Construct your own metric ruler.

TOPIC 95: Identifying Metric Relationships

Aim: How are common metric units of length related to each other?

Performance Objectives: Students will be able to:

- identify the seven common units of length in the metric system
- explain each unit's decimal value in relation to a meter
- convert measurements from one metric unit to another

Materials:

- MS DOS computer with color monitor
- software: Metric IV: Linear Units by Classroom Consortia Media, Inc.

Motivation:

Place the following words on the board - underline the prefixes.

millimeter	(thousandth)
centimeter	(hundredth)
decimeter	(tenth)
meter	
decameter	(ten)
hectameter	(hundred)
kilometer	(thousand)

Have students use a dictionary or textbook glossary to look up the meanings of the words with prefixes and fill in the chart as shown in parentheses.

Point out to students that the prefixes for smaller units are derived from Latin; those of the larger units are derived from Greek.

Development:

1. Have students load software into the disk drive and turn on the computers and monitors.

2. When the menu appears, direct the students to type 2 and press RETURN.

3. A review of metric relationships will be displayed. Ask students to read the relationships and discuss how these relationships are formed based on the meter.

4. Students will have already performed the first part of section #2 when learning how to use the metric ruler. Ask students to review this part of the section again. Instruct students to stop viewing when they reach a screen that displays metric relationships again.

5. Direct students in reviewing these relationships and explain that there will be a problem that will test for an understanding of these relationships. Students may want to copy this information at this point until they are familiar with the relationships.

6. Help students to perform the exercise which requires measuring in centimeters and converting this measurement to other metric units. (A sample of the exercise should be performed by the teacher so the students may observe how to change one unit to another.)

7. Instruct students to exit the program when they have completed the problem. Ask students to type the letter E and press RETURN to indicate that they want to end the section. The menu will reappear. Direct

students to type 6 and press RETURN to exit.

8. Direct students to remove disks, turn off computers and monitors, and return disks to their protective sleeves.

Summary:

1. What units are used to measure length in the metric system?
2. What is the unit upon which all other metric units of length are based?
3. How are centimeters changed to meters? (divide by 100)
4. How are meters changed to kilometers? (divide by 1000)

Homework:

Prepare rexographed sheet of fill-ins such as:
26 cm. = ______ mm.
250 cm. = ______ m.
3 km. = ______ m.
27 hm. = ______ m.
or make an appropriate assignment from student text.

Enrichment:

Complete the table:

mm	cm	dm	m	dcm	hm	km
5,000,000		50,000	5000			5
			275		2.75	
		300				.03
				68		
2567						

TOPIC 96: Using the Metric System to Calculate

Aim: How do we perform simple mathematical operations using the metric system?

Performance Objectives: Students will be able to:

- measure distance using metric units
- calculate perimeter using metric units

Materials:

- MS DOS computer with color monitor
- software: Metrics IV: Linear Units, Classroom Consortia Media, Inc.

Motivation:

Suppose we wanted to measure the total metric height of our class. How would we do this? What metric unit would be the best unit to measure with? Elicit the possibility of using either cm. or m. (in hundredths) the height of each student, with conversion to meters (in hundredths) for the total.

Development:

1. Review metric unit relationships and concept of perimeter.
2. Instruct students to insert software into disk drives and turn on computers and monitors.
3. When menu appears, have students type 3 and press RETURN.
4. Direct students in an oral reading of the computer-provided review of the metric system.
5. The computer provides a series of motivational problems for the purpose of introducing metric units measuring distance and perimeter. Encourage student responses to these situations.
6. After the motivational problems, have students complete the set of five perimeter problems which the computer presents. Choose a student to read the instructions to the problems in order to ensure accurate student responses. Perform the first problem together. Instruct students to record all answers on their papers in millimeters and centimeters.
7. A second set of five more complex problems is presented. Perform first problem together. Instruct students to record all answers on their papers in millimeters and centimeters.
8. Upon completion of the two sets of perimeter problems, instruct students to type E and press RETURN in order to end this section of the software. When the menu reappears, direct students to type 6 and press RETURN to end the program.
9. Direct students to remove disks, turn off computers and monitors and return disks to their protective sleeves.

Summary:

1. How are distance calculations performed using metric units?
2. How are perimeter calculations performed using metric units?

Homework:

1. Assignment of appropriate math text pages.
2. Using the perimeter calculations from the 10 problems performed in class, convert these measurements into meters and decimeters.
3. Compute the perimeters in meters and decimeters for five of the problems.

Enrichment:

Have students measure the length and width of 10 rectangular objects. List the measurements in both mm. and cm. (to the nearest tenth) and find perimeter and area of each object. Express answers in both mm. and cm. (to the nearest tenth).

TOPIC 97: Calculating the Area of a Parallelogram and a Triangle

Aim: How can the area of a parallelogram and a triangle be measured and calculated?

Performance Objectives: Students will be able to:

- calculate the area of a parallelogram when the base and height are known
- calculate the area of a triangle when the base and height are known

Materials:

- MS DOS computer lab
- software: Measurement Process: Distance and Area by IBM
- duplicated copies of activity sheet

Motivation:

Hand out activity sheet; allow students about five minutes to complete it. What do the figures have in common? Do you see any pattern in your results? What conclusion can you draw? Elicit from students that the estimates for all the rectangles and parallelograms are about the same and that the triangles are about half that amount. The dimensions of all the figures are the same.

Development:

1. Review with students the method of finding the area of a rectangle by multiplying its length by its width.

2. Tell the students that the programs which they are about to use will use their experience with rectangles to show them how to measure the area of parallelograms and triangles.

3. Remind students of proper disk handling techniques and have them load the Area disk into drive A. Students should turn on computer and monitor and wait for the program to load.

4. Students should follow program directions until menu appears, then select Activity 6 - Area of a Parallelogram and wait for program to load. Anwser NO to any option to review.

5. The computer-directed instruction will show a parallelogram and under student control will cut off one end with a perpendicular, move it to the other end and form a rectangle. The relationship of length and width to base and height will be established and the formula for area of a parallelogram defined. When asked to continue to Area of a Triangle, student should type YES.

6. This section will show that a triangle can be copied and the congruent triangles placed together to form a parallelogram. The student is led to understand that the area of a triangle is half that of a parallelogram with the same base and height. Base and height are defined for acute, obtuse, and right triangles. Right triangles are combined to form rectangles.

7. Allow students about ten minutes to complete the computer activity. Have students remove disk, turn off the computer and monitor and return the disk to its protective pocket.

Summary:

1. How is the area of a rectangle found?
2. How are the dimensions of a rectangle named?
3. How are the dimensions of a parallelogram named?
4. How does the area of a parallelogram compare with the area of a rectangle with the same dimensions?
5. How does the area of a triangle compare with the area of a parallelogram with the same dimensions?

Homework:

Prepare a rexographed sheet of various sized parallelograms and triangles and have students calculate the area of each, or make an appropriate assignment in the student text.

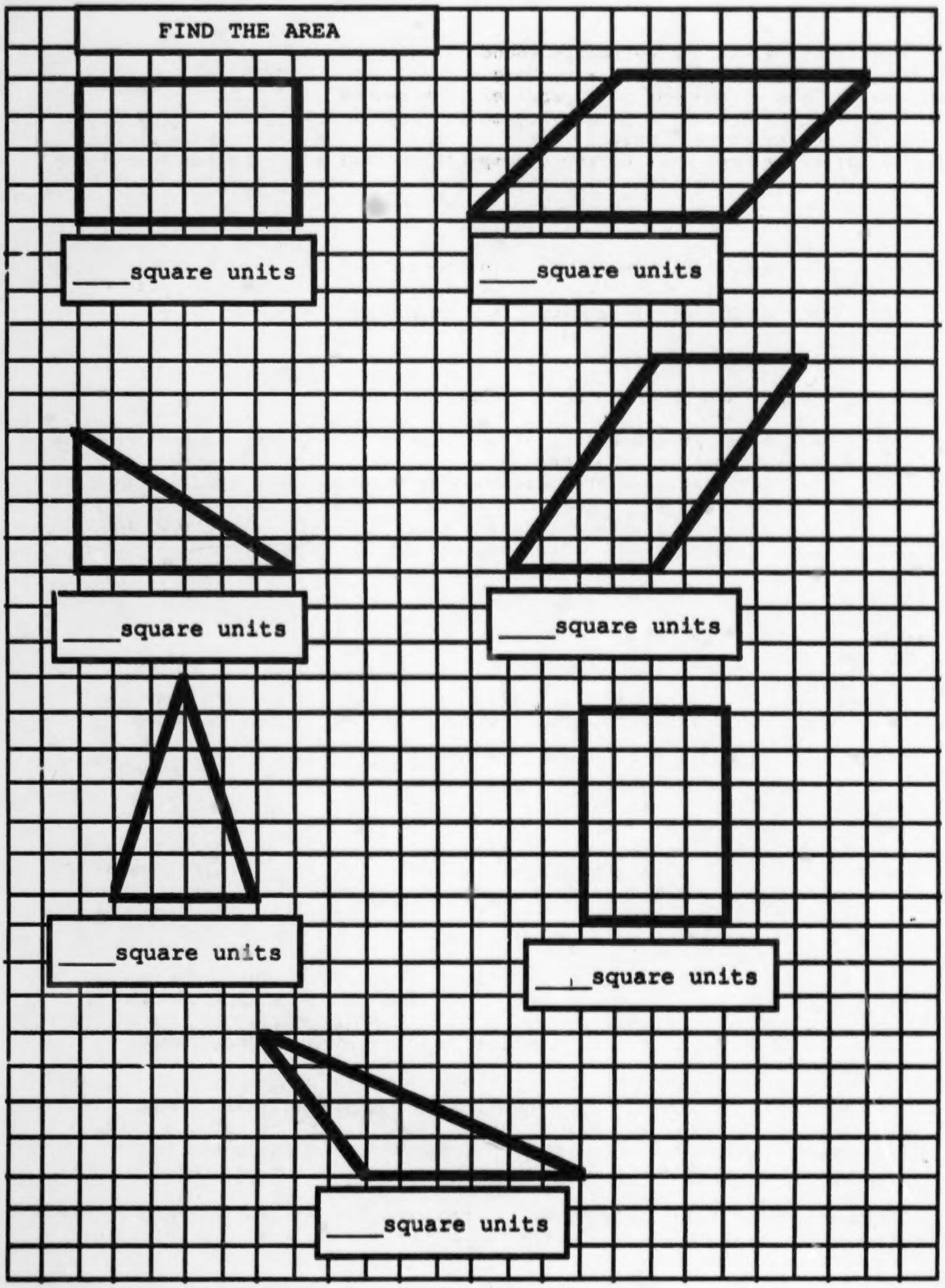
Enrichment:

Have students use grid paper to investigate the effect on the area of a parallelogram and a triangle of:

- a. doubling the base
- b. doubling the height
- c. doubling both the base and the height

NAME____

FIND THE AREA



____square units

____square units

____square units

____square units

____square units

____square units

____square units

TOPIC 98: Estimating Area

Aim: How can squares and grids be used to estimate area?

Performance Objectives: Students will be able to:

- measure an irregular shaped region by comparing it to a single square
- calculate the area of an irregular region by using a grid and counting squares inside the region and those boundary squares which are mostly inside

Materials:

- MS DOS computer lab
- software: Measurement Process: Distance and Area by IBM
- United States map (one for each or a large wall map)
- duplicated copies of activity sheet

Motivation:

Distribute maps. Write a list of at least 10 states on the board. Have students list them in order from largest to smallest by observation. Make some of the choices obvious, some difficult. Have students compare lists. Where student opinions differ, have some students justify choice. Elicit suggestions of ways to confirm correct order. Why are regularly shaped western states easier to judge?

Development:

1. Tell students that the programs they are about to use will teach them several ways to estimate the area of regions of various shapes.

2. Remind students of proper disk handling techniques and have them load the Area disk into drive A. Students should turn on computer and monitor and wait for the program to load.

3. Students should follow program directions until menu appears and then select Activity 1 -- Estimating Area and wait for program to load.

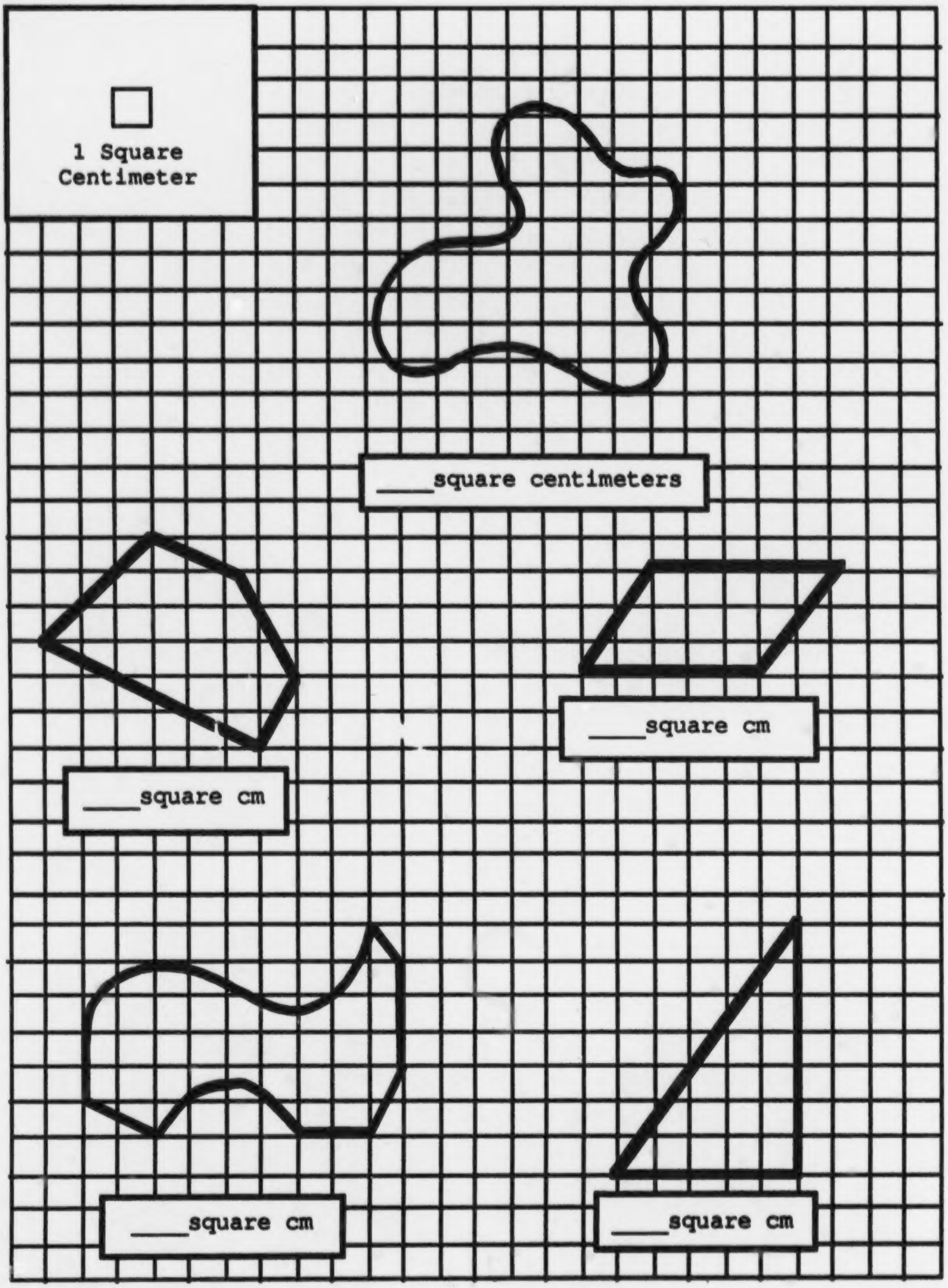
4. The first computer-directed activity has the student estimate the area of an irregular lot of land by comparing it to a square which can be made larger or smaller. The student must match several irregular regions with a square whose size the student controls. When asked to continue to Divide and Conquer, student should type YES.

5. In this activity, area estimation is refined by covering the region with a grid of squares. Students are guided toward more accurate estimation by counting the squares which are more than half inside the region. When asked to continue to Practice Measuring Areas, the student should type and YES.

6. The student will now be given practice in estimating areas with square grids of various sizes and will finish the activity by using a grid to measure the area of a rectangle. The students end the computer activity by typing NO, when asked to continue to Several Units of Area.

7. Allow students about 15 minutes for the computer activity. Have students remove disks, turn off computers and monitors and carefully return disks to protective pockets.

NAME____


1 Square
Centimeter

____square centimeters

____square cm

____square cm

____square cm

____square cm

Summary:

1. How can a square be used to estimate area?
2. How can a grid of squares be used to estimate area?
3. How does the size of the squares affect the estimate of area?
4. How does the direction in which the grid is placed affect the estimate of area?

Homework:

Duplicate the attached activity sheet for each student and have the student write an estimate for each area.

Enrichment:

Using tracing paper and a map of South America, students should prepare a grid on the tracing paper using the scale on the map. By counting squares estimate the area of each country and list them from largest to smallest. From an atlas or other reference book obtain the actual areas and compare results.

TOPIC 99: Calculating Area

Aim: How can units of area be used to measure plane region?

Performance Objectives: Students will be able to:

- create arbitrary units of measure
- measure an area using various units of measure
- explain the relationship between the size of the unit of measure and the area
- identify standard units of area
- calculate areas using standard units of measure

Materials:

- MS DOS computer lab
- software: Measurement Process: Distance and Area by IBM
- unit of measure tables for both customary and metric units (one for each student or one large chart for display)

Motivation: Put the following on the chalkboard:

1. Using any object you have with you (pen, pencil, key, I.D. card, etc.) measure the length of your arm.
2. Choose another object, either larger or smaller and make the same measurement again.
3. On paper draw squares with each object as the length of the sides.
4. Use each square to measure the surface of your desk.

How long is your arm? Why can't we use just a number to answer the first question? What happens to the number in the measurement when the unit becomes larger? when it becomes smaller? How are the units of length used to measure your arm related to the units used to measure your desk? Elicit the concept that surfaces are measured in square units and that the measurement is called area.

Development:

1. Refer to the Unit of Measure tables. Have students select units which can be used to measure area; make certain the student uses square units to define area.

2. Tell students that the programs they are about to use will allow them to measure areas of various shaped regions with units of their own choosing and then will show them how to use standard units of measure.

3. Remind students of proper disk-handling techniques and have them load the Area disk into drive A. Students should turn on the monitor and computer and wait for the program to self-load.

4. Students should follow program directions until menu appears and then select Activity 4 - Several Units of Area and wait for the program to load.

5. The computer-directed instruction will allow students to choose a square unit and measure several regions using this unit. It will have them use a different unit to measure the same areas and will then lead them to compare the results. Students will discover the usefulness of a standard unit of measure.

6. At the end of the first unit, when asked to continue to Standard Units of Measure, students should type YES.

7. The next section introduces the student to the square centimeter and square inch, has them use these standard units to measure the area of several regions and guides them to select units of area from a list of assorted units of measure. End the computer portion of the lesson by having students type NO, when asked to continue to Area of a Parallelogram.

8. Allow students about 12 - 15 minutes for the computer-directed activity. Have them remove disks, turn off monitor and computer and carefully return disk to protective pockets.

Summary

1. What kind of units measure area?
2. Why are standard units of measure needed?
3. What are the two parts of every measurement?
4. What happens to the number in the measurement when the unit becomes larger? when it becomes smaller?

Homework:

Prepare a rexographed square centimeter grid with several regions marked and have students find the area. Include polygons of various shapes and some irregular regions whose areas can be estimated by use of the grid.

or

Make an appropriate assignment from the student text.

Enrichment:

Using a United States or world map, make a unit square using the scale on the map. Make a list of at least 10 states or countries. Use your unit square to estimate the area. Use an atlas or other reference book to find the actual areas. Compare results.

TOPIC 100: Measuring the Volume of a Box

Aim: How can we measure the space inside a box?

Performance Objectives: Students will be able to:

- define volume of a three-dimensional object
- measure the volume of a box using cubic units
- measure the volume of a box using the standard formula: V = l x w x h

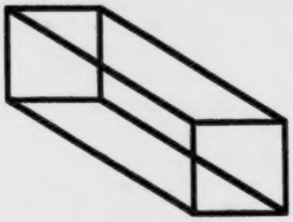
Materials:

- Apple computer lab (color monitors)
- software: Math Sequences by Milliken Publishing Co.
- unit cubes
- small rectangular boxes

Motivation:

Write the following on the chalkboard:

How can we measure the space inside this?



What do we have in the classroom that might help us? How many unit cubes will it take to fill the box?

Development:

1. Prior to the motivation, the concept of the unit cube must be developed. The students should understand that each unit cube represents the space of one cubic unit.

2. After the Motivation, present a number of problems geared to develop the idea that placing unit cubes in the box by rows and layers represents the same as the measurements of the outside of the box. The formula V = l x w x h should be introduced and developed. The following program will greatly assist the teacher in reinforcing the concepts taught and use of the above formula.

3. Tell the students that the program they are about to use will teach them how to measure the volume of a box.

4. Prior to bringing the class into the computer lab, the teacher must place certain information on the disk. Load the disk. When the Title Page appears, hold down CONTROL and press the letter I.

5. Select option A - ADD A CLASS. The screen prompts NAME OF TEACHER TO ADD? Use MATH for the teacher's name. The screen then prompts CLASS NAME; again select MATH. Then the screen prompts PASSWORD?; again select MATH (the screen displays XXXXXXXXXX).

6. Finally select option B - RETURN TO TITLE PAGE. This must be done for each disk in the measurement formulas series. It need only be done once.

7. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

8. When the Title Page appears, tell the students to press RETURN. The screen prompts for a name; the students will input MATH. When the screen prompts for a class number, the students input 1. When the screen prompts for a password, the students will input MATH.

9. Ideally there should be one computer for each student. Most classes, however, require 2 to 3 students per computer. Since this software is also a management system, it presents a number of options for the teacher. If the one student per computer situation exists, then before the class enters the lab, the teacher should record each student's name into the system, so that an ongoing record of each student's work can be preserved. If the 2 or 3 student situation exists, it is recommended that the management system not be used. The students will then sign onto the system as a teacher (review #8), and work on one skill area only. The system will not retain records of the work.

10. After signing onto the system, tell the students to select option C, REVIEW SEQUENCE AS A STUDENT. Then instruct them to select option A ANIMATION. When the screen prompts BEGINNING LEVEL?, the students are to input 17 to 20 (which corresponds to today's lesson).

11. Each student can then work on the problems on a rotation basis. The screen offers a problem, and the student then inputs an answer. If correct, the screen provides a graphic congratulating the student. If incorrect, the screen prompts PRESS RETURN, and gives the student another chance. If incorrect twice, the screen provides the correct answer for the student, and then goes on to the next problem.

12. After a period of time, the computer will begin to increase the level of difficulty, if the students demonstrate mastery at the current level. If not, the students remain at the same level until they either demonstrate mastery, or fall below a predetermined percentage. In this case, the students are instructed to go to the teacher for help.

13. After a 20-minute session, the teacher can ascertain the mastery of today's lesson at each computer very easily. When the ESC key is pressed, the screen will total up the number of problems attempted, the number of correct responses, and the percentage.

14. Two to three sessions are recommended.

Summary:

1. What does volume mean?
2. How can we use unit cubes to measure volume?
3. If a box has the following measurements of its sides: L = 3, W = 4, H = 5, what is the volume of the box?

Homework:

See attached homework sheet

Enrichment:

If a box has a volume of 144 cubic units:

1) L = 8, W = 9, H = ?

2) L = 6, W = 6, H = ?

3) L = 12, W = 2, H = ?

4) W = 3, L = 8, H = ?

5) L = ?, W = ?, H = 72

Homework Sheet:

Volume of A Rectangular Box

Part One

1) What does the word volume mean? ______________________________

____

2) In the formula, V = L x W x H, what is the meaning of:

a) L ______________________________________

b) W ______________________________________

c) H ______________________________________

Part Two: Find the volume of a rectangular box that has:

1) L = 2, W = 4, H = 5

V = L x W x H

V = 2 x 4 x 5

V = 40 cubic units

2) L = 4, W = 7, H = 1 ______________________________

____

____

3) L = 5, W = 5, H = 2 ______________________________

____

____

4) L = 10, W = 10, H = 2 ______________________________

____

____

PART XI

Data and Graphing

TOPIC 101: Coordinate Systems

Aim: What is a grid? How can a point or location on a grid be named?

Performance Objectives: Students will be able to:

- define a grid
- give at least two examples of commonly-used grids
- use two numbers to name any point on an 8 by 7 grid
- given a point on a grid, tell how many over (right) and how many up to another point

Materials:

- Apple II computer (II+, IIe, or IIc)
- software: The Math Professor #2852 - Grid Locations by Bergwall Educational Software, Inc.
- a street map, U.S. map or globe, picture of a tall building, chalk, chalkboard

Motivation:

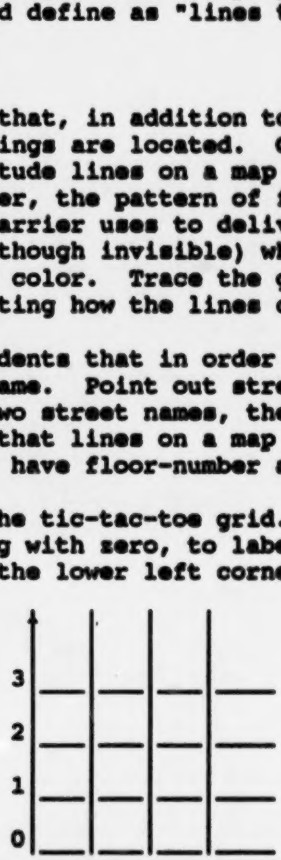
Display maps and a picture of a building. Ask students what might be the same about the pictures. Accept all reasonable responses. If no one notices the grid lines and patterns, draw a tic-tac-toe grid on the board and tell students that the pictures have a "grid" in common, similar to the little grid used to play tic-tac-toe. Write the word "grid" on the board and define as "lines that cross each other."

Development:

1. Explain that, in addition to playing games, grids are useful for showing where things are located. Give several examples, such as the longitude and latitude lines on a map or globe, the pattern of streets that cross each other, the pattern of floors and rooms in a tall building that the letter carrier uses to deliver mail, and the lines on a television screen (though invisible) which a computer uses to locate each dot of light or color. Trace the grid lines on the displayed pictures with your hand, noting how the lines cross each other.

2. Tell students that in order to locate a place on a grid, each line must have a name. Point out street names on street map. Demonstrate that by giving two street names, the place where they cross can be located. Explain that lines on a map have number and/or letter names, rooms in a building have floor-number and letter names.

3. Expand the tic-tac-toe grid. Tell students we will use number names, beginning with zero, to label each line. Label the grid, starting with zero in the lower left corner.



Explain that to name the point where two lines cross, two number names must be given. Demonstrate on chalkboard. Have two or three students name a point as you put your finger on it on the grid.

4. Tell students they will be using a computer program which will let them practice using number names to tell where a point on a grid is located. Review correct handling of disks. Tell students to insert disk into drive A, turn on monitor and computer power. The program is self-loading.

5. Each screen has instructions so that students may work independently. Some students may be prompted if they have trouble locating or following the on-screen instructions. Students will type their first name, then wait for the next screen. Students may choose to skip the review lesson and go directly to the game by typing Y or they may review how to locate points on a grid by typing N. Tell students to follow the instructions that appear on the screen. Tell them to press RETURN every time they want to go on to the next question.

6. Tell students there are two games on the disk. The first game is a review for practicing how to name the location of a point. When students feel comfortable with that game, tell them to try the second game. The next game shows two points. Students are to tell how many units to the right and how many units up the second point is from the first.

7. After 10 or 15 minutes, tell students to remove disk, turn off computer and monitor, and to put diskette into its protective cover.

Summary:

1. What is a grid?
2. Name two examples of grids people use.
3. What must you know in order to locate a point on a grid? (two names: how far right and how far up from the starting point).

Homework:

1. Play tic-tac-toe but use the points where lines meet instead of the spaces between the lines.

2. Find and write the two names for each of these locations:
   a) the streets for the location of your school
   b) the streets for the location of the building where you live
   c) the apartment where you live (e.g., a street and number or a floor number and an apartment letter).

Enrichment:

1. Learn and play the game Battleship.

2. Find or draw a map which shows your school and where you live. Name the locations for your school and for the building you live in using your own grid or the grid on the map. Tell how far right and up from either your building to your school or from your school to your building.

3. Find another kind of grid that was not shown in class.

4. Make up an expanded tic-tac-toe game using four, five, or six in a row points for winning.

TOPIC 102: Plotting Points to Create Shapes

Aim: How can points on a grid be used to create shapes?

Performance Objectives: Students will be able to:

- draw standard grids and fill in numbers 0 to 10
- draw a picture on the grid using given reference points

Materials:

- Apple computer lab (color monitors)
- software: Bumble Games by The Learning Co.
- graph paper
- rulers

Motivation:

Place the following on the chalkboard:

If you wanted to draw a picture and make the shapes a certain size, how could you use graph paper and a grid?
How does graph paper make it easy to get the measurements exact?
(Show the class an object drawn on graph paper.)

Development:

1. After the motivation, use the grid to draw familiar shapes such as: squares, rectangles, triangles, and trapezoids.

2. Tell students that the program they are about to use will teach them how to draw shapes on the grids.

3. Remind the students of the correct method for handling disks and tell them to insert the disk into the disk drive. The students should turn on the monitors and computer power. The program is self-loading.

4. When the menu appears on the screen, instruct the students to select option 6 - BUMBLE DOTS. The screen will ask if the students want instructions, (Y or N). Have students type Y.

5. The instructions are simple, using easy vocabulary. The screen then prompts to input a bottom number (0 thru 4). The selected number along the bottom then becomes highlighted, as well as a corresponding vertical grid line.

6. Then tell the students to select # 1 - BUMBLE'S PICTURES.

7. A menu appears to select a drawing: kite, clown, house, boat and whale. When a selection is made, a grid appears.

8. On the grid is a blinking dot. The students must input the correct grid coordinates. If correctly entered, the shape is finally drawn. If not, the screen prompts the student to the correct coordinates. Assist the students in deciding on coordinates.

9. One or two sessions are recommended.

Summary:

How would you do the following?

1. Draw a standard grid, 10 units by 10 units.
2. Draw a square on the grid, having a 4 unit side.
3. Draw a triangle on the grid, having a base of 5 units.

Homework:

See attached homework sheet

Enrichment:

Draw a picture of a TV screen on a plain piece of paper. List the point coordinates that you could use to draw it on a grid.

Homework Sheet

Drawing shapes on a grid

Part One Without plotting the points given, what shapes will they make?

1) (2, 0)
(2, 5)
(5, 0) ______________

2) (2, 5)
(5, 2)
(5, 5)
(2, 2) ______________

3) (2, 0)
(8, 0)
(4, 5)
(6, 5) ______________

Part Two Draw a boat on a grid. What points did you use?

Part Three To make a square, which point is missing?

1) (2, 6)
(7, 6)
(2, 1)
(?, ?)

2) (3, 10)
(7, 10)
(3, 6)
(?, ?)

TOPIC 103: Locating Coordinates

Aim: How can we locate ordered pairs?

Performance Objectives: Students will be able to:

- locate a grid position by identifying its horizontal and vertical locations
- use ordered pairs to represent a location
- read ordered pairs on a grid or array system

Materials:

- Apple IIe lab
- software: Bumble Games by The Learning Company
- large graph tablet for demonstrations
- graph paper

Motivation:

Distribute paper to the students. Ask them to hold their paper vertically and fold it in half twice. Then ask them to fold the paper in half horizontally twice. Open up the paper. How many columns are there? How many rows? Display a student's paper that was folded correctly. If you wish, have students who did activity correctly help those who did not.

Development:

1. Discuss the places or things in the school that use rows or columns (i.e. auditorium, classroom, report cards). Elicit from the students the reasons why seating in the auditorium or the gymnasium is in rows.

2. Display a chart-sized graph tablet. Distribute one sheet of graph paper to the students. Have students label the columns with letters and the rows with numbers.

3. What box is in the C column and the number 5 row? Have a student locate the C column with the right finger and use the left finger to find the fifth row. The student should move both fingers until the box that is in the same row and the same column is reached. Use a colored pencil to shade in the box. Repeat this activity for two more boxes. Students should shade in the boxes on their graph papers.

4. The program "Find the Bumble" will give the students additional practice locating boxes in an array. Students should load the program, Bumble Games, into their computers. When the menu appears, all students should select number 2 and wait for the program to begin. The teacher should demonstrate one problem with the entire class before allowing the students to work individually or in pairs.

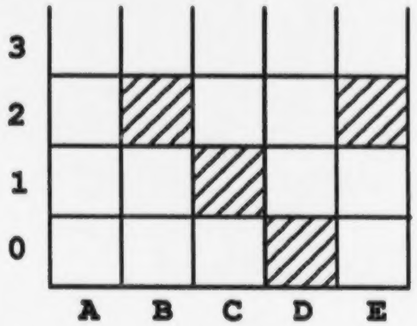
5. Allow the student ten to fifteen minutes using the program.

Summary:

Display a graph with shaded boxes on the graph tablet.

1. Which labels represent the rows? Which labels represent the columns?
2. Where are the following ordered pairs?
   a. C,0 b. B,2 c. D,4

3. What are the ordered pairs for the shaded boxes?



Homework:

Fold a sheet of graph paper into four boxes. Draw a horizontal line for the row and a vertical line for the column. Then shade in boxes for the ordered pairs given below.

1. (F,5)
2. (A,0)
3. (D,2)
4. (C,2)
5. (A,4)

Enrichment:

1. Computer Activity: Select the "Butterfly Hunt". Students will use their directional skills to discover the ordered pairs for the missing butterfly.

2. Off Computer: Create the initials of your first and last name. Shade in the boxes for the initials. Then write the ordered pairs needed to create your initials.

TOPIC 104: Creating Graphics by Plotting Points

Aim: How are points represented on the x and y axes?

Performance Objectives: Students will be able to:

- identify points on a 5x5 or 10x10 grid
- use number-pair notation to identify locations
- read x and y coordinates on an array
- create graphics using ordered pairs on a grid

Materials:

- Apple IIE lab
- software: Bumble Games by The Learning Company
- geoboards
- graph paper
- red and blue rubber bands
- colored pencils

Motivation:

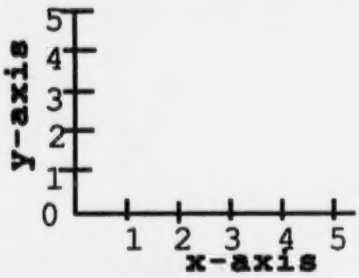
Display a square, a rectangle, and a triangle on the geoboards with red rubber bands representing the x-axis and blue rubber bands representing the y-axis. Ask students to identify the shapes and to look for a particular pattern for the red and blue rubber bands.

Development:

1. Introduce the new vocabulary words: x-axis, y-axis. Discuss the direction for the x and y axes.

2. Review the graph with ordered pairs in shaded boxes. Discuss the need to represent more information on graph paper (i.e. weather or temperature daily readings, ratings of television shows).

3. Display a graph with the x and y axes using numbers.



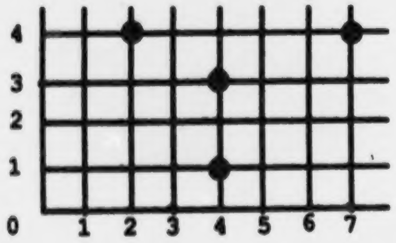
4. Have students create the x and y axes on their graph paper. Remind students to label the line and not the boxes.

5. Practice showing the students how to locate ordered pairs for x and y when they are number pairs. Students should make a point when the number pairs are located. Find these coordinates: (5, 2) (1,3) (4,1)

6. Students are to use Bumble Games for additional practice in plotting number pairs. When the program is loaded and the menu appears, students should select number 4, "VISIT FROM SPACE."

Summary:

1. What are the x and y coordinates for the ordered pair, (7,4)?
2. What geometric shape is created when the following ordered pairs are plotted and a line connects the points?
   (0,4) (0,0) (3,0)
3. Label the points on the given diagram.



Homework:

Plot the following points on graph paper. Connect the points. What shape was created?
(4,1) (1,4) (6,4) (4,8)

Enrichment:

Computer Activity: Students should work on the Tic-Tac-Toe or Bumble Plot for plotting points. Two players are needed to play Tic-Tac-Toe.

Off Computer: Follow the class attendance record for the week. Create a grid that represents days of the week and the total number of students in the class. Each day record the number of boys present with a colored pencil and the number of girls present with another pencil. At the end of the week connect the points for each group. Then compare the two lines represented.

TOPIC 105: Using the Cartesian Coordinate System

Aim: What is the Cartesian Coordinate System for locating points?

Performance Objectives: Students will be able to:

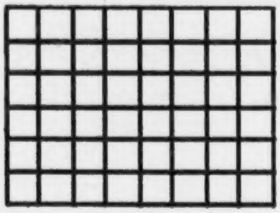
- describe Cartesian Coordinate System
- locate points on a grid using x and y coordinates.
- tell in which quadrant a given point lies
- complete a drawing of a message by placing and connecting points on a Cartesian grid

Materials:

- Apple II computer (II+, IIe, or IIc)
- software: Coordinate Geometry by Ventura Educational Systems
- chalk (white plus two other colors, if possible), chalkboard, worksheet

Motivation:

Draw this grid on the chalkboard using white chalk.



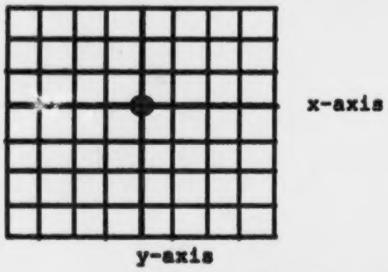
Review with students:
- grids are used to locate points.
- each point on a grid has two names (usually numbers and/or letters) to tell its location.

Development:

1. Tell students they will be using a program which will help them learn about a special kind of grid which is used by many, many people.

2. Above the grid drawn on the board, write "Cartesian Coordinate System." Explain that this kind of grid is named for a famous mathematician - Descartes. Explain each element of the system as you use colored chalk to draw the lines and labels on the grid.

3. The Cartesian system divides the grid into four parts by means of two lines: the horizontal line is called the x-axis (use a color to draw and label the x-axis on the grid already on the board); the vertical line is called the y-axis. The four sections are called quadrants: quadrant I, II, III, IV going counter-clockwise. The center point is called the origin and is labelled zero. All lines are numbered from the zero-point or origin.



4. Explain and label the lines. Tell students that moves up the y-axis or to the right on the x-axis are written by numbers with no sign in front of them. Movements down the y-axis or to the left on the x-axis are written with a minus sign in front of them. Label the grid on the board and demonstrate how to name a point. Show and name a point in each quadrant so that students see how to use the minus sign. Tell students the center point is named 0,0. Moves along the x-axis are always given first - this number is called the x-coordinate or abscissa. Moves along the y-axis are given second - this number is called the y-coordinate or ordinate.

5. After a few examples, ask for volunteers to name a point you indicate on the grid.

6. Tell students they will now review and practice using the Cartesian Coordinates on the computer. Review correct handling of disks. Tell students to insert disk into drive A, turn on monitor and computer power. The program is self-loading.

7. Tell students that after about a minute they may press RETURN when they see the message in the bottom right corner of the screen. Press RETURN again and wait a few seconds for the menu to appear. Press RETURN again to select (x,y). Remind students they may use the arrow keys to make choices, press ESCAPE to get back to the main menu, and press RETURN after each selection.

8. On the (x,y) menu, students may review the parts and names for the Cartesian Coordinate System by selecting the Lesson. Students who feel confident enough may use the right-arrow key to select Probe. The Probe choice allows students to practice naming an x-coordinate and a y-coordinate and locating the named point on a grid.

9. Allow students about ten minutes to practice naming points. Then instruct students to press RETURN instead of entering a number when they are ready to take the quiz. Tell students to use the right-arrow to select Quiz and then press RETURN. Allow about ten minutes for Quiz.

10. Tell students to remove disk, turn off computer and monitor power, and put diskette into its protective cover.

Summary:

1. Describe the elements of the Cartesian Coordinate System:
   - the x-axis
   - the y-axis
   - the origin
   - the abscissa
   - the ordinate
   - the four quadrants

Homework:

1. Distribute worksheets to be completed for homework.

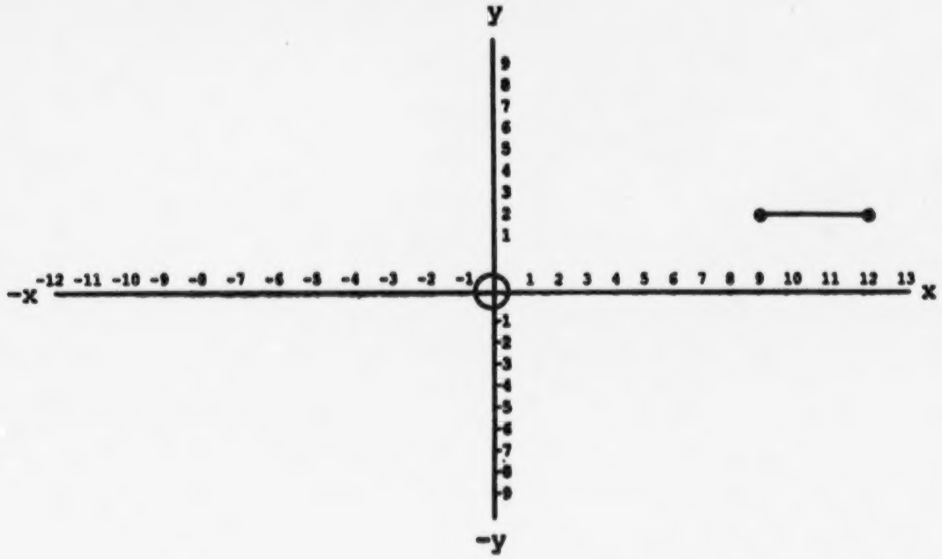
Enrichment:

1. Design your own connect-the-dots picture using Cartesian coordinates to name the dots.

2. Play Battleship on a Cartesian coordinate grid.

HOMEWORK SHEET

Instructions: Put a dot at each point named in a list. Connect the dots in the order given in the list. Each list is for making a different letter in the message. You will spell out a message when all the lists have been done. The first two dots have been done for you.



y
9
8
7
6
5
4
3
2
1
-x
-12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
1 2 3 4 5 6 7 8 9 10 11 12 13
x
-1
-2
-3
-4
-5
-6
-7
-8
-9
-y

Quadrant I

9,2
12,2
12,5
10,5
10,6
12,6
12,7
9,7
9,4
11,4
11,3
9,3
9,2

5,2
7,2
7,7
5,7
5,2

Quadrant II

-16,3
-16,6
-15,6
-14,5
-13,6
-12,6
-12,3
-13,3
-13,4
-14,3
-15,4
-15,3
-16,3

-11,3
-9,6
-7,3
-8,3
-9,4
-10,3
-11,3

-6,3
-6,-5
-7,5
-7,6
-4,6
-4,5
-5,5
-5,3
-6,3

0,3
-1,3
-1,4
-2,4
-2,3
-3,3
-3,6
-2,6
-2,5
-1,5
-1,6
0,6
0,3

Quadrant III

-8,-11
-3,-11
-3,-7
-4,-7
-4,-9
-5,-9
-5,-8
-6,-8
-6,-9
-8,-9
-8,-11

0,-6
-1,-6
-1,-3
-3,-3
-3,-8
0,-8

Quadrant IV

0,-6
1,-6
1,-3
3,-3
3,-8
0,-8

5,-3
5,-8
7,-8
7,-6
9,-8
11,-8
11,-3
9,-3
9,-6
7,-3
5,-3

TOPIC 106: Creating Bar Graphs

Aim: How is data displayed in a bar graph?

Performance Objectives: Students will be able to:

- identify the parts of a horizontal and vertical bar graph
- read and analyze the data displayed in a bar graph
- create a bar graph

Materials:

- Apple IIe lab
- software: Exploring Tables and Graphs by Xerox
- construction paper
- New York Times' Business Sections (must include at least one bar graph)
- scissors
- paste or glue

Motivation:

Show the class examples of table and picture graphs. Then ask students how information would be represented in a bar graph.

Development:

1. Use a demonstration monitor and load the program. When the menu appears, students should select Bar Graphs. Then choose All About Bar Graphs. Have a student read the information aloud. Answer any questions.

2. Distribute the business sections of several New York Times newspapers. Students are to locate bar graphs in those sections and cut them out. Compare the information on the computer bar graphs with the bar graphs used in the newspapers.

3. Direct students to load machines with the program. Have students select the Examples section of the Bar Graphs unit. Students should be given at least seven to ten minutes to complete the section.

4. After completing the Examples section, students are to play three rounds of Blockade. Then have the computer graph the scores on a bar graph. Record the scores on a separate sheet of paper.
   Use construction paper to create a bar graph different from the one done by the computer. (If the computer created a horizontal bar graph, the student should make a vertical bar graph.)

Summary:

1. What are some things that bars represented in the bar graphs you saw?
2. How are large number quantities represented in a bar graph?
3. What does a bar graph have in common with a picture graph?
4. Based on the table below create a bar graph.

MOVIE	RATING
1. La Bamba	3
2. Superman IV	2
3. Summer School	1
4. Robocop	3
5. Jaws	3
6. Revenge of the Nerds	2
7. My Life as a Dog	3 $\frac{1}{2}$
8. Adventures in Babysitting	3

Homework:

Use magazines or newspapers and clip out three examples of bar graphs and the articles about the graph.

Enrichment:

Computer: Select a picture graph that you have worked on and create a bar graph on the computer.

Off Computer: Research the type of hobbies students like to do. Use a bar to represent how many girls and how many boys favor a particular hobby.

TOPIC 107: Organizing Data Into Tables and Graphs

Aim: How is information displayed in an area graph?

Performance Objectives : Students will be able to:

- identify the parts of an area graph
- read and analyze data in an area graph
- create an area graph

Materials:

- Apple IIe lab
- software: Exploring Tables and Graphs by Xerox
- index cards
- construction paper
- scissors
- glue or paste

Motivation:

Distribute index cards to each student. Tell students to place their favorite subjects in order from one to five. Collect all the cards. Create a table based on the data.

Development:

1. What kind of graphs could be used to see how divided the class is about the subject areas? Discuss the types of data suitable for a picture and a bar graph.

2. Have students load their computers with the program Exploring Tables and Graphs and read about Area Graphs. Students are to find out the following information:
   What does an area graph look like?
   What kind of information is suitable for this type of graph?
   Allow students at least five to seven minutes on this assignment.

3. After students have read the data on the area graph, elicit answers for the assigned questions.

4. Direct students to select the Examples section. Tell the students to use the information given in this section to help them use the data on the Subjects Table to create an area graph.

5. Students should be allowed enough time to preview the Examples section and use construction paper, scissors, and markers or pencils to create the graph.

Summary:

1. What is an area graph?
2. How is information displayed in an area graph? (based on the student-made graphs of Favorite Subjects)
3. How many parts of the graph are needed for the Favorite Subjects data?
4. Which subject is the most popular?
5. Which subject is the least popular?
6. How many subjects make up about one-half of the graph?

Homework:

Make an area graph that displays types of foods you eat during the course of a day. Divide the foods into their respective categories.

Enrichment:

On Computer: Play the game, Blockade. After the computer creates an area, graph your scores and develop a table based on the data.

Off Computer: Find out if your block is more residential or more commercial. Survey the type of buildings on your whole block (include all four sides). Use an area graph to display the stores or commercial buildings, homes or residential unit, and others (e.g., fire department, hospital, police precinct, etc.).

TOPIC 108: Creating Picture Graphs

Aim: How is information displayed in a picture graph?

Performance Objectives: Students will be able to:

- identify the elements of a picture graph
- read and analyze data in a picture graph
- create a picture graph

Materials:

- Apple IIe lab
- software: Exploring Tables and Graphs by Xerox
- chart tablet
- paper cutouts of the class members (boy and girl figures)

Motivation:

Determine how many students were born under each Zodiac sign and display the zodiac table of the class. Set up a picture graph outline on the board. (Include the column and row headings for the zodiac signs) Ask students to use the information from the table to determine how many paper cutouts should be put in each row. When the graph is completed, the teacher should ask the students if they know the name of the kind of chart they have created with the paper cutouts. Elicit the response picture graph.

Development:

1. What do the paper cutouts represent? Explain to the students that symbols are used to represent information on a picture graph. What other symbol could be used for this graph?

2. Use a demonstration model monitor and load the program. When the menu appears, the instructor or student should select Picture Graphs. Then select All About Picture Graphs. Have a student read the information aloud. Answer any questions regarding the information.

3. Before sending students to their computer stations, the instructor should ask the students to look for specific information.
   a. What are the major differences between the table and a picture graph?
   b. What kind of information is best suited for the picture graph?
   c. How are large quantities of information represented in a picture graph?
   d. Why is a table a helpful tool when creating a picture graph?

4. Each student should load the computer with the program. Select Picture Graphs and then review the Examples section of the program. Instruct students to use the Game program after completing the Examples section first. Allow students at least ten minutes to complete the activity.

Summary:

1. What are the major differences between a table and a picture graph? What are the similarities?
2. What kind of information is best suited for a picture graph?
3. What is a key? When is a key needed in a picture graph?
4. How are fractional parts of numbers represented?

5. Why is a table a helpful tool for creating picture graphs?
6. What are the advantages of using a picture graph?

Homework:

Translate the information from the Television Show table into a picture graph. Create a symbol that best represents the information.

Enrichment:

Off Computer: Select a topic for a picture graph (i.e. favorite food, or popular music artist, favorite sport, etc.). Poll the grade level for the data. Then record information in table form and in a picture graph. Be sure to include symbols and a key for the graph.

Computer: Use Exploring Tables and Graphs to create a computerized graph. Load side two of the disk and select Create a Table. Record your table data onto the computer. Then follow the instructions in the program for picture graphing.

TOPIC 109: Organizing Data to Perceive Patterns

Aim: How can we identify patterns?

Performance Objectives : Students will be able to :

- define a pattern
- use directionality instructions for problem solving
- develop strategies for identifying patterns

Materials:

- Apple IIe lab
- software: Pond Corvus by Sunburst (also available for MS DOS and Commodore computers)
- dot-to-dot chart

Motivation:

Have six students stand in the front of the classroom in the following order: boy-girl-boy-girl. Ask the class to listen carefully to the way students are asked to come to the front of the room. Try the activity again but use a different strategy for calling students (i.e. students wearing similar clothing). Ask class to think of other ways the students can be called up.

Development:

1. Sing a song in a round (e.g., Row Your Boat). Ask the students to determine what the each activities in the Motivation and singing the song have in common. Introduce the word pattern to the students. Discuss the definitions of pattern.

2. Place the following items on the chalkboard:
   What comes next?

   A B C D A B C -----

   1 3 5 7 9 ---

   shoes, chair, gloves, book, earrings, pencil, ________

   Which problem can have more than one kind of answer?

3. Distribute dot-to-dot sheets to the students. Tell the class to listen carefully to the instructions that will be given. Follow the directions and connect the dots.
   Pattern A: face down - two down - right - two down - right - two down
   Pattern B: face up - four up - right - go forward two left - four up - right - go forward two
   Pattern C: face down - two down - right - forward five - left - one down

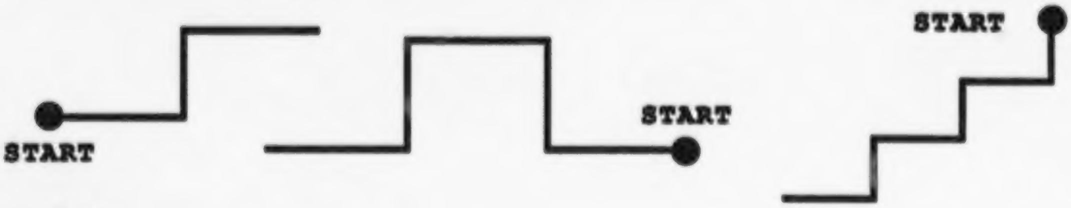
4. Explain to the students that the program they will be using has lots of patterns to be discovered. Students are to look for the repeating factor. When they know the pattern, they should test it.

5. Students should boot up the program and select Level One - Farmer Jane's Ponds. When the menu appears, students should use the practice mode

before playing the game. Students should be given at least twenty minutes on task.

Summary:

1. What is a pattern?
2. What should a person look for when trying to identify the pattern?
3. Look at the shapes below. Write the instructions for them using the arrow steps from the program:



Homework:

Make a list of items that contain patterns in your home. See the example below:

staircase
floor tiles

Enrichment:

On Computer: Select "Billy Bob's Ponds" with distractors and try to identify the pattern for the frog jumps.

Off Computer: Draw a neighborhood map of your house and the school. Highlight in different colors the different routes you could take to get to school.

PART XII

Appendices

Software Duplication Guidelines

Like plays, novels, songs, textbooks, and all other published material, the programs and files on a published computer diskette are fully protected by the copyright laws of the United States. No diskette can legally be copied without the appropriate permission of the publisher. The position of the Division of Computer Information Services of the New York City Board of Education on diskette copying is the following:

1. Duplication of copyrighted software or documentation is prohibited.
2. Software publishers must be contacted to verify procedure for back-up multiple copies and licensing agreements.
3. A publisher's written permission is required to download or network programs to other microcomputers.
4. No student or Board of Education employee may use school computers to duplicate copyrighted software.
5. The use of illegally duplicated software, however obtained, is prohibited in all Board of Education facilities.
6. Simultaneous use of original software and/or its back-up is not permitted without the written permission of the publisher.

The copyright of the enclosed diskettes, however, belongs exclusively to the New York City Board of Education. Any New York City public school employee may make an unlimited number of copies of these diskettes for use in the New York City public schools, either in day or evening sessions, without obtaining further permission. For your convenience, and to enhance the educational value of these programs, it is strongly advised that you make at least one copy of each diskette for each computer in your computer lab to allow all of your students to work on the same program simultaneously.

The New York City Board of Education has computer diskettes under contract at this time. If you wish to purchase additional diskettes, they are available under the Board of Education contract # P-3086, item # 11-99-6000.00.3 from:

Athana Incorporated
Suite 106
2730 Monterey Street
Torance, California 90503
1-800-421-1591
Att: Carol Romeo

Copying Public Domain Diskettes for MS DOS Computers

Diskcopy with One Disk Drive

To make a copy of a software diskette on an IBM PC, PCjr, or IBM compatible computer with a single disk drive, follow these steps:

1. Before you start, be sure that the diskette you wish to copy is write-protected. Write protecting a diskette will prevent you from accidentally erasing or overwriting any of its programs or files. You can write-protect a diskette by placing a small piece of tape over the write-protect notch on its left side.

2. Insert the IBM DOS diskette into the disk drive, turn the computer and the monitor on, wait for the DOS to boot up, then enter the date and time. The last line on the screen will be A>.

3. Type Diskcopy, then press ENTER. The screen will display the message,

   ```
   Insert SOURCE Diskette in Drive A :
   Press any key when ready . . .
   ```

   The SOURCE diskette is the diskette you want to copy. Remove the DOS diskette from the disk drive and insert the Source diskette. Press ENTER.

4. The screen will display a Copying . . . message, then the following instructions:

   ```
   Insert TARGET Diskette in Drive A :
   Press any key when ready . . .
   ```

   The TARGET diskette is the diskette you want to copy to. Remove the source diskette from the disk drive and insert the Target diskette.

   (NOTE: It is not necessary to format a new diskette before using it as the target diskette. Diskcopy will format automatically before copying.)

   Press ENTER.

5. If your target diskette has not been formatted before, the screen will display a Formatting . . . message before it copies. After it has formatted and copied, it will repeat the message it gave you in step 4:

   ```
   Insert SOURCE Diskette in Drive A :
   Press any key when ready . . .
   ```

   Remove the target diskette from the disk drive and insert the source diskette again. Press ENTER.

6. After another Copying . . . message, the screen will repeat the message from step 5:

   ```
   Insert TARGET Diskette in Drive A :
   Press any key when ready . . .
   ```

Again, remove the source diskette from the disk drive and insert the target diskette. Press ENTER.

7. This is the last stage of the procedure. When the screen displays the message

   ```
   Copy another diskette (Y/N)?
   ```

   the procedure is over; the target diskette has been made into a duplicate of the source diskette.

8. If you want to make another copy of the source diskette, type in Y. The screen will repeat the message

   ```
   Insert SOURCE Diskette in Drive A :
   Press any key when ready . . .
   ```

   You can repeat this procedure as many times as necessary and make as many copies of your original diskettes as you need for use in the New York City public schools. When you no longer wish to make additional copies, press N and remove the source diskette from drive A.

Diskcopy with Two Disk Drives

Copying on an IBM PC or IBM-compatible computer with two disk drives is an even easier procedure, because it doesn't require alternately removing and inserting the source and target diskettes. Follow the directions for steps 1 and 2 for a computer with one disk drive, then type in Diskcopy A: B: at step 3 and press ENTER. The screen will display this message:

```
Insert SOURCE Diskette in Drive A :
Insert TARGET Diskette in Drive B :
Press any key when ready . . .
```

Remove the DOS diskette, insert the source and target diskettes into the proper disk drives and press any key on the typewriter keyboard. The screen will display a Copying . . . message while it copies the source diskette and a formatting . . . message if the target diskette hasn't already been formatted. When the screen displays the message

```
Copy another diskette (Y/N)?
```

the procedure is over; the target diskette has been made into a duplicate of the source diskette. If you want to make another copy of the source diskette, type in Y and repeat the procedure.

Copying Public Domain Diskettes for the Apple II

To make a copy of your software diskette, follow these steps:

1. Before proceeding, be sure that the diskette you wish to copy is write protected. Write protecting your diskette will prevent you from accidentally erasing or overwriting any of its programs or files during this or any other use of the diskette. You can write protect a diskette by placing a small piece of tape over the write protect notch on the diskette's left side.

2. Insert the DOS 3.3 System Master diskette into drive 1 and turn the computer and the monitor on. When the Applesoft prompt and cursor appear appear type in RUNCOPYA and press RETURN.

3. The screen will display the message

```
APPLE DISKETTE DUPLICATION PROGRAM
ORIGINAL SLOT:    DEFAULT = 6
```

   Press RETURN.

4. The screen will display

```
ORIGINAL SLOT: 6
        DRIVE:    DEFAULT = 1
```

   Again, press RETURN.

5. The screen will display

```
        DRIVE: 1
```

   and add a new message:

```
DUPLICATE SLOT:  DEFAULT = 6
```

   Press RETURN.

6. The screen will display

```
DUPLICATE SLOT: 6
```

   and ask one last question:

```
        DRIVE:    DEFAULT = 2
```

   If you are using an Apple II Plus or IIe with one disk drive, change the number 2 to 1 and press RETURN. If your machine has two disk drives, simply press RETURN. The screen will display

```
-- Press 'RETURN' key to Begin Copy --
```

7A. If you are using a computer with two disk drives, the screen will give you no further instructions. Remove the DOS 3.3 System Master diskette and insert the source diskette into drive 1. (The source diskette is the diskette you want to copy.) Insert the target diskette into drive 2.

(NOTE: It is not necessary to format a new diskette before using it as the target diskette. The Apple II Plus or IIe will format it automatically before copying onto it.)

Press RETURN. Reading and Writing messages will appear alternately as the computer reads the source diskette and writes onto the target diskette. If the target diskette has not been formatted before, the screen will also display Formatting.

7B. If you are using a computer with a single disk drive, press the RETURN key. You will have to alternately insert and remove both the source diskette and the target diskette during the copying procedure. The screen will tell you what to do at the proper times. Follow its instructions carefully. When you insert the target diskette for the first time, the screen will display the word Initializing while it proceeds.

When the screen displays the message

```
DO YOU WISH TO MAKE ANOTHER COPY?
```

the procedure is over; the target diskette has been made into a duplicate of the source diskette.

8. If you want to make another copy of the source diskette, type in Y and press RETURN. The screen will repeat the message

```
-- Press 'RETURN' key to Begin Copy --
```

You can repeat this procedure as many times as necessary and make as many copies of your original diskettes as you need for use in the New York City Public Schools. When you no longer wish to make additional copies, press N and remove the source diskette from drive A.

Caring For Your Diskettes

Your computer diskettes will provide years of dependable service if you and your students handle them properly by following a few simple procedures.

1. Never handle a diskette unnecessarily. When it is necessary to touch a diskette, hold it by the corner near the label, and touch as little of its surface as possible. Under no circumstances should you ever touch the interior magnetic recording surface, either through the center of the diskette or any other opening in the diskette cover.

2. Never bend or fold a diskette.

3. Whenever possible, write out the diskette label before affixing it to the diskette. If it is necessary to write on the label after it has been affixed to the diskette, always use a felt tipped pen or marker. Never write on the diskette with a pencil or ball point pen.

4. Never attach anything to a diskette with a paper clip of any kind.

5. When a diskette is not in use, always return it to its paper envelope. store it in a cool, safe place, away from direct sunlight, excessive heat, moisture, dust, and dirt of any kind.

6. Computer diskettes are magnetic, and any contact with other sources of magnetism can destroy the programs and files that are stored on them. Keep your diskettes away from magnets of any kind, no matter how harmless they seem to be. Magnetic desktop paper clip holders (a principal source of trouble because they aren't obvious), magnetic children's toys and so forth can damage your diskettes.

   In addition, many common electric and electronic appliances are sources of magnetism. Televisions, radios, electric lights, and even the screen of your computer monitor produce minute amounts of magnetism which can cause diskette damage. Store your diskettes away from these devices when they are not in use, and do not allow your diskettes to come into contact with them when you are using them.

7. Never attempt to clean a diskette with cloth or fluid.

8. Always write protect your important diskettes by covering the notch in the left side with tape. This will keep you from accidentally erasing or overwriting an existing program or file.

9. Finally, accidents that ruin or erase diskettes are bound to happen. Learn how to use the diskcopy and copy commands on your DOS, and, as a precaution, always make back-up copies of any diskettes you would find difficult or impossible to replace.

For More Help

The Division of Computer Information Services maintains a Technical Assistance Center (TAC) in each of the five boroughs. These centers are equipped with a wide variety of computers, software, and, most important, experienced advisors to help you use the computers in your school more effectively and to answer any questions about computer education you may have. All New York City public school teachers are welcome to make use of TAC facilities, either by telephone or in person, at any time during the year. TACs are normally open from 9 A.M. to 5 P.M. during the school year and through all school vacations, including the summer, but daily hours can vary. Call first.

Bronx TAC
1000 Teller Avenue
Bronx, N.Y. 10456
(212) 588-0279

Brooklyn TAC
3000 Avenue X
Brooklyn, N.Y. 11235
(718) 769-2860

Manhattan TAC (N)
134 West 122 Street
New York, N.Y. 10027
(212) 662-0122

Manhattan TAC (S)
122 Amsterdam Ave. - Rm. 374
New York, N.Y. 10023
(212) 769-2710

Queens TAC
167-01 Gothic Drive
Jamaica, N.Y. 11432
(718) 658-0491

Staten Island TAC
1200 Manor Road
Staten Island, N.Y. 10314
(718) 494-5042

List of Software Used in This Guide

Title	Publisher	Type of Computer	ISBN No.
Basic Math Competency Skill	Educational	Apple	55-7372.80.1
Building: Fractions and Decimals	Activities	MS DOS	55-7371.75.9
		Comm.	55-7370.15.9
Bumble Games	Learning Co.	Apple	91-7995.62.7
		Comm.	91-7995.98.8
Computational Skills: Basic Fractions	Houghton Mifflin	Apple	39-5419.99.9
Counters: An Action Approach to Counting and Arithmetic	Sunburst	Apple	60-1510.63.1
Elementary Mathematics Classroom Learning System (Fractions and Decimals)	D. C. Heath	MS DOS	66-9352.29.6
Exploring Tables and Graphs	Xerox	Apple	60-1512.15.4
Geometric PreSupposer	Sunburst	Apple	91-1831.35.5
Grid Locations	Bergwall	Apple	80-6470.52.6
Inequalities	Bergwall	Apple	80-6470.56.9
Learning Division	Classroom	Apple	92-2928.63.0
	Consortia	MS DOS	92-2928.37.1
Mastering Beginning Geometry and Algebra	Softwriters	Apple	
Math - Multiplication I	Continental Press	Apple	84-5481.91.6
Math Sequences	Milliken	Apple	60-1511.52.2
Math Shop	Scholastic	Apple	59-0964.64.X
		MS DOS	59-0978.93.4
Measurement Process: Distance and Area	IBM	MS DOS	90-2530.01.1
Metrics IV: Linear Units	Classroom Consortia	Apple	90-3510.04.9
The New Arithmetic Classroom: Division	D.C. Heath	Apple	88-4084.48.5
The New Arithmetic Classroom: Number Ideas	D.C. Heath	Apple	66-9354.09.0
Perimeter	Bergwall	Apple	80-6470.66.6
Place Value	Centurion	Apple	65-1510.83.6
Pond Corvis	Sunburst	Apple	55-6363.69.8
		MS DOS	55-6363.63.9
		Comm.	55-6363.71.X
Rounding	Bergwall	Apple	80-6470.63.1
Softtext: Math - Addition II	Continental Press	Apple	84-5481.89.4
Symettry	Bergwall	Apple	80-6470.61.5